OAK TREE FARM PHASE III

(PUD-97-01)

DRAFT SUPPLEMENTAL ENVIRONMENTAL IMPACT REPORT SCH#97092040

CITY OF PLEASANTON

March 1998

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CHAPTER 1: INTRODUCTION

1.1 Background

In 1986, the applicant (Currin Construction Company) applied to Alameda County for approval to construct 56 single-family custom homes on approximately 91 acres on Foothill Road, just south of the Castlewood résidential development. An EIR was prepared by the County that included this subdivision and a nine-lot subdivision on 10 acres on the east side of Foothill Road. This EIR was certified in August, 1989, but the approved tentative subdivision map allowed only for construction of the nine homes on the east side of Foothill Road, subject to the condition that the new development be served by public sewer. The City of Pleasanton then approved an agreement with Currin Construction Company in January, 1990 to provide sewer service to both the 10-acre site and the 91-acre site. Pleasanton applied to the Local Area Formation Commission (LAFCO) for annexation of the 91-acre property, along with 250 acres of East Bay Regional Park District land to the west. This annexation was completed in August, 1991. The EIR prepared by the County is incorporated herein by reference.

After annexation, the Currin Construction Company requested City approval of a development plan for 69 homes to be located on the 91-acre site on the west side of Foothill Road. A Supplemental Environmental Impact Report (SEIR) (SCH#90030991) was prepared by the City of Pleasanton and certified in 1992, which is incorporated herein by reference. After the SEIR was certified, the Pleasanton City Council approved a Planned Unit Development (PUD, PUD-89-17) for a 55-lot subdivision on the 91-acre site called Oak Tree Farm.

One of the requirements of the SEIR and the PUD conditions of approval called for further geotechnical studies prior to any City approvals of the project's tentative subdivision map (tentative map). Later, at the time of the tentative map review, the City determined that the hillside area of the site, for which 17 lots were proposed, had not been demonstrated to be stable to the satisfaction of the City Council or the City's reviewing geologist. Consequently, the 17 lots were eliminated from the tentative map. The remaining 38 lots, which comprise Phase I and Phase II of Oak Tree Farm, have recorded final subdivision maps and construction of single-family custom homes is occurring.

In 1996, the applicant conducted further geotechnical studies for the 17 lots. The results of these studies have been reviewed by a peer reviewing geologist selected by the City. The new studies indicate that the hillside area is stable, although mitigation measures are required to reduce potential significant impacts to a less than significant level. In addition, the applicant has reduced the number of proposed lots from 17 to 13, for a final total of 51 lots in the Oak Tree Farm subdivision.

1.2 Purpose

The purpose of this Draft Supplemental Environmental Impact Report (SEIR) is to assess the impacts of Phase III of the proposed Oak Tree Farm Planned Unit Development (PUD) residential development (PUD-97-01). This is the final phase of the Oak Tree Farm residential subdivision. The applicant, Currin Construction Company, has applied to the City of Pleasanton for approval to develop 13 (instead of 17) lots for a custom, single-family home subdivision on approximately 13.5 acres of

the 91-acre site, located on the west side of Foothill Road, across from the Verona Bridge. As stated above, Phases I and II were approved as PUD-89-17 in 1992. Final maps have been recorded for these phases and construction of 37 single-family homes is underway.

This SEIR is prepared as an informational document for decision-makers and the public, which identifies the significant environmental effects of the project, and possible ways to minimize such effects. The SEIR is intended as an aid in the public review and decision-making process of projects subject to the discretionary action of public agencies. It is not the purpose of an SEIR to recommend either approval or denial of the project.

This SEIR has been prepared by the City of Pleasanton as the "Lead Agency" to analyze the potential environmental impacts associated with the proposed project.

1.3 Contact Person

The primary contact person is Ms. Kathryn Watt, Associate Planner for the City of Pleasanton. Ms. Watt can be reached at 510-484-8023.

1.4 Legal Requirements

Pursuant to California Environmental Quality Act (CEQA) Guidelines, a Notice of Preparation (NOP) and Initial Study/Environmental Assessment was issued by the City on September 8, 1997, in accordance with the requirements of the California Code of Regulations, Title 14, Section 15082(a), 15103, and 15375. The required 30-day review period for the NOP was from September 8, 1997 to October 7, 1997. The NOP indicated that an SEIR was being prepared and invited comments on the proposed project from public agencies and the general public. The NOP, Initial Study/Environmental Assessment, and comments received are included in this document as Appendix A.

This SEIR has been prepared in accordance with the California Environmental Quality Act of 1970 (Public Resources Code, Section 21000 *et. seq.*) and the *Guidelines for Implementation of the California Environmental Quality Act* published by the Resources Agency of the State of California (California Code of Regulations, Section 15000 *et. seq.*), and in accordance with the City's local CEQA Guidelines. This SEIR contains all components required by CEQA, as outlined in Table 1-1.

1.5 SEIR Requirement

CEQA and the State CEQA Guidelines require the preparation of an SEIR when, through the preparation of an Initial Study/Environmental Assessment, it is determined that a project, for which an EIR had been previously prepared, is changed and may have significant impacts on the environment that had not been identified in the previous EIR. Based on the findings of the Initial Study/Environmental Assessment prepared for the Phase III Oak Tree Farm development proposal, the City of Pleasanton has required the preparation of an SEIR pursuant to Section 15081 of the State CEQA Guidelines.

This is an SEIR in conformance with the CEQA Guidelines because: "...subsequent changes are proposed in the project which will require important revisions of the previous EIR...due to the involvement of new significant environmental changes not considered in a previous EIR...on the project" [Section 15162(a)]. In this case, the change in the project is a reassessment of geologic conditions on the hillside portions of the site. This SEIR is a supplement to an FSEIR prepared for Phases I and II of the Oak Tree Farm residential subdivision (PUD-89-17), which was certified by the Pleasanton City Council April 7, 1992. While portions of this SEIR rely heavily on the previous SEIR, the document has been updated to reflect the changes in the project, new geologic investigations required by the City, and changes in land uses in the surrounding areas.

1.6 Public Review and Comment

This Draft SEIR is available for public inspection at the Planning Department of the City of Pleasanton, 200 Old Bernal Avenue, Pleasanton, California. Reference copies of this SEIR can be reviewed at the Alameda County Public Library, located at 400 Old Bernal Avenue, Pleasanton, California. Organizations and individuals are invited to comment on this Draft SEIR. Where possible, respondents are asked to provide any additional information which they feel is not contained in this Draft SEIR, or indicate where the information may be found.

Following a 45-day period of circulation and review of this Draft SEIR, all comments and the City's responses to those comments will be incorporated into a Final SEIR prior to certification of the document by the City Council.

Also available for review at the City of Pleasanton Planning Department are the EIR prepared by Alameda County and the SEIR (SCH#90030991) prepared by the City of Pleasanton for the subject site.

1.7 Organization of the SEIR

This SEIR is organized into 10 chapters, plus appendices. This chapter is the Introduction. The next chapter, Summary, provides a brief project description and summarizes project impacts, mitigation measures, and alternatives. A detailed project description is provided in Chapter 3. The environmental analysis of project impacts is detailed in Chapters 4 through 8, including mitigation measures. Chapter 9 lists impact conclusions, and alternatives to the proposed project are examined in Chapter 10. Appendix A includes the Initial Study/Environmental Assessment, the NOP, and letters responding to the NOP. Appendix B contains a list of persons and documents consulted in researching the SEIR, as well as City of Pleasanton staff and consultants who prepared the SEIR. Reference documents cited in the SEIR are on file at the Pleasanton Planning Department and the Alameda County Planning Department. The geotechnical analyses are included in Appendix C.

The format of this SEIR is intended to present the project and environmental analysis in individual chapters, or sections, as suggested by CEQA. However, several topics in this SEIR are interrelated (e.g., visual impacts and wildlife and vegetation impacts), and the reader is encouraged to review the entire SEIR to better understand the overall scope of the proposed project.

1.8 Scope of the SEIR

This Draft Supplemental Environmental Impact Report has been prepared by the City of Pleasanton Planning and Community Development Department in accord with the requirements of the California Environmental Quality Act (1970), as amended, the State implementing guidelines, and the City's local guidelines. As a result of the Initial Study scoping process, the report focuses on the following issues and potential impacts:

- Land Use and Planning
- Geology, Soils, and Grading, Hydrology and Drainage
- Visual Impact
- Noise
- Vegetation and Wildlife

As previously stated, geotechnical issues are included in this SEIR because there has been a reassessment of geologic conditions on the hillside portions of the site.

Land use, visual and vegetation issues have been addressed in this SEIR because the number of lots as well as their configuration has changed since the 1992 SEIR was certified.

An analysis of noise impacts has been included in this SEIR to determine if noise levels at the lots have significantly increased due to additional vehicle traffic on I-680.

This document describes the likely environmental consequence of project approval and construction in relation to each of the issues identified above. The potential individual and cumulative effects that the project might have on the environment are assessed, possible ways to mitigate potential significant adverse effects are recommended, and alternatives to the project are evaluated.

1.9 Categories of Impact

The SEIR makes findings on the significance of impacts the project may cause. These findings are placed in the following categories:

- A "Less than Significant" impact is considered to cause no substantial adverse change in the environment;

- A "Potentially Significant" (adverse) impact is one that is considered, but cannot be determined for certain, to be significant;

- A "Significant" (adverse) impact is considered to cause a substantial adverse change in the environment;

- A "Significant and Unavoidable" (adverse) impact is one which is considered to cause a substantial adverse effect on the environment, but which cannot be avoided even with mitigation measures if the project is implemented; and

- A "Beneficial" impact is one which would cause a beneficial effect on the environment.

TABLE 1-1
Required Contents of an SEIR

Required Section from CEQA Guidelines	Section/Page in SEIR
Table of Contents (Section 15122)	Table of Contents
Summary (Section 15123)	Chapter 2
Project Description (Section15124)	Chapter 3
Environmental Setting (Section 15125)	Chapters 4 through 8
Environmental Impact (Section 15126)	Chapters 4 through 8
Significant Environmental Effects Of Proposed Project (Section 15126a)	Chapter 2, Chapters 4 through 8, Chapter 9
Unavoidable Significant Environmental Effects (Section 15126b)	Chapter 2, Chapters 4 through 8, Chapter 9
Mitigation Measures Proposed to Minimize Significant Effects (Section 15126c)	Chapter 2, Chapters 4 through 8, Chapter 9
Alternatives to the Proposed Project (Section 15126d)	Chapter 10
Significant Irreversible Environmental Changes Resulting from Implementation Of the Proposed Project (Section 15126d)	Chapter 2, Chapters 4 through 8, Chapter 9
Relationship Between Local Short-Term Uses Of the Environment and the Maintenance and Enhancement of Long-Term Productivity (Section 15126e)	Chapter 9
Growth-Inducing Impacts of the Proposed Project (Section 15126g)	Chapter 9
Effects Found Not to be Significant (Section 15128)	Chapter 2
Organizations and Persons Consulted (Section 15129)	Appendix B.
Cumulative Impacts (Section 15130)	Chapter 9
Preparers of the SEIR (Section 15129)	Appendix B
Comments on Draft SEIR, List of Those Commenting, Responses to Comments (Section 15132)	Final SEIR

CHAPTER 2: SUMMARY

This SEIR addresses the relationship of the proposed Oak Tree Farm Phase III (PUD-97-01) development to the existing environment, both on-site and in the project vicinity. The primary impacts and recommended mitigation measures are summarized chapter by chapter on the following pages. In addition, a brief description of each project alternative considered is provided. A complete impact analysis and mitigation measures are covered in specific chapters of this SEIR. If there is a question of interpretation, the applicable chapter shall take precedence over the summary.

2.1 Summary of Project Description

The applicant, Currin Construction Company, is requesting approval of a 13-lot subdivision on 13.5 acres of a 91-acre site that comprises the Oak Tree Farm residential subdivision. The project site is located on the east side of Pleasanton Ridge, north of Sunol and south of Castlewood Country Club. The 13-lot subdivision is Planned Unit Development (PUD)-97-01, which is Phase III (the final phase) of the Oak Tree Farm residential subdivision. Phases I and II, which were approved as PUD-89-17, allow for a total of 38 units, and are currently under construction. As with Phases I and II, the applicant will construct the streets and utilities, but the design and construction of each house would be the responsibility of each lot owner.

2.2 Effects Not Found to be Significant

The following effects were found not to be significant in the Environmental Checklist Form (Appendix A):

- Air Quality
- Water (Runoff, Flood Hazard, Quality and Quantity of Surface and Ground Waters)
- Transportation, Circulation
- Public Services (Police, Fire, Schools, Parks, Maintenance)
- Utilities (Water, Sewer, Drainage, Solid Waste)
- Energy
- Archaeological or Historic Sites

2.3 Conformance with Plans and Policies

The project site has a General Plan designation of Planned Unit Development (PUD) Low Density Residential and PUD Rural Density Residential. Lots 1 through 4 are within the Low Density land use designation, while lots 5 through 13 are within the Rural Density land use designation. General Plan policies provide for density transfer within a site, provided that the overall density for the entire site does not exceed the overall maximum. The overall site plan (i.e., for all three phases) shifts some units out of the Rural Density Residential areas and locates them on lots within the Low Density Residential portions of the site. The General Plan permits such flexibility within the confines of a site.

Therefore, there is no inconsistency created by a slight mismatch of density between the proposed development plan and the General Plan Land Use Map. The proposed project, in the context of the entire Oak Tree Farm project, is consistent with the density allowances identified by the General Plan for this site.

The project site is zoned as Planned Unit Development (PUD). In addition, the site is zoned as part of the West Foothill Road Corridor Overlay District (WFRCOD). The WFRCOD sets development and design standards for residential developments proposed for properties on the west side of Foothill Road. When the City Council approved PUD-89-17 (Phases I and II), it allowed a relaxation of some of the standards due to the site's unusually flat topography along Foothill Road and the topographical constraints of the hill. Other standards intended to reduce the project's visual impacts and maintain a "rural" character were implemented through the requirement for a approval of lot-by-lot design guidelines for all 51 lots of the PUD. The other standards include: height limits; unit size limits; split pad lot designs; grading limitations, etc.

The *Oak Tree Farm Architectural and Landscape Design Guidelines* of August 25, 1992 are the result of relaxation of the WFRCOD standards while implementing the goals of the WFRCOD, that is, to maintain the aesthetic, rural character of the Foothill Road corridor, as well as provide opportunities for custom homes, recreation, open space and preservation of the City's most visible resource. In addition, the WFRCOD guidelines are included in the Architectural and Landscape Design Guidelines as an appendix. These design guidelines are to be used for all three development phases at Oak Tree Farm.

2.4 Summary of Impacts, Mitigation Measures and Mitigation Monitoring Recommendations

Major impacts and mitigation measures associated with the project are summarized below.

A. Land Use and Planning (Chapter 4)

Impacts

Due to measures incorporated into the project from the *Oak Tree Farm Architectural and Landscape Design Guidelines*, impacts related to land use were considered less than significant. However, to ensure that all of the applicable conditions of approval from PUD-89-17 are implemented with this project, the following mitigation measure has been included for the project.

Mitigation Measures

4.3.1 Mitigation Measure: The applicant shall add a new section to the Architectural and Landscape Design Guidelines that specifically applies to Phase III of Oak Tree Farm. The section shall include all applicable mitigation measures, conditions of approval, and a map showing the location of the 13 lots.

B. Geology, Soils, and Grading, Hydrology and Drainage (Chapter 5)

Impacts

1. The Terrasearch analyses reviewed the slope stability for various possible soil strength parameters and groundwater conditions to evaluate the stability of the ancient landslide, and its potential impact on the proposed development of the 13 lots. The analyses concluded that the ancient slide underlying the proposed project is stable under static conditions for the groundwater conditions that could be expected to occur at the site. The Alan Kropp & Associates evaluation of the reports by Terrasearch and Kleinfelder concurred with this conclusion. **Therefore, impacts related to the stability of the ancient landslide under static conditions are less than significant, and no mitigation measures are required or recommended.**

2. Kleinfelder, Inc. conducted pseudo-static slope stability analyses to evaluate the stability of the ancient landslide under seismic conditions. Based on the results of these analyses, the landslide will remain stable (i.e., a factor of safety greater than one) under seismic shaking associated with a lower level seismic event for the ranges of soil strength properties estimated and with all estimated possible groundwater conditions. The non-linear deformation analysis indicated negligible deformation during a lower level seismic event. However, during an upper level seismic event, the ancient landslide may experience some movements. According to the analysis prepared by Alan Kropp & Associates, the most severe differential movements would take place on Lot 9, and a house located at the toe of the slope on Lot 5 would have differential movements of approximately one-half of those on Lot 9. **In the absence of mitigation measures, impacts to the proposed improvements related to the ancient landslide during an upper level seismic event are potentially significant.**

3. Hydrologic data developed by Greiner Engineering, Inc. (1987) indicate that the proposed project will increase storm water runoff from the project area by an average of 30 to 48 percent for a typical rainfall year. In some sub-basins, runoff from a 15-year storm will be increased by as much as 50 to 83 percent. The three major hillside ravines could have flows up to 70 cfs with velocities in the 10 feet per second range and flow of approximately a 2-foot depth. **This is considered a potentially significant impact.**

4. The evaluation prepared by Alan Kropp & Associates indicates that the remedial work for both active and older active landslides should be similar. The evaluation also states that many of the areas of landslides called recent in the Terrasearch analysis that affect the proposed lots may also have a very high potential for activity. **In the absence of mitigation measures, this is considered a significant impact.**

Mitigation Measures

5.3.1 Mitigation Measure: Any structures and improvements constructed on the slope of any landslide shall have flexible utility connections to accommodate ground movement during an earthquake.

5.3.2 Mitigation Measure: In terms of the ancient landslide, during a major earthquake, deformation of the landslide materials may occur. To accommodate this potential deformation, the foundations for all structures on Lots 1 through 13 shall be designed and reinforced to withstand a landslide deformation during a major earthquake, and this requirement shall be included in the Architectural and Landscape Design Guidelines. In addition, the street pavement and utility lines shall be designed to take into account a total differential movement of nine inches over 800 feet, which translates into a compressive strain of 0.1 percent.

5.3.3 Mitigation Measure: The remedial work for both active, older active, and recent landslides shall be similar, because the older active landslides have nearly the same potential for future movements as the active landslides, and because many of the so-called recent landslides may also have significant potential for future activity.

5.3.4 Mitigation Measure: The currently proposed buttress for Lots 1 through 4 may not be of sufficient size to restrain the very large landslide complex which extends upslope and beyond the limits of the project site. The current layout of the lots as shown on Map 5-1 do not appear to have adequate mitigation by the conceptual buttress shown on the map. Prior to approval of the tentative subdivision map, additional site-specific design work shall be performed to the satisfaction of the City to address this issue.

5.3.5 Mitigation Measure: For Lots 7 and 9, 30-foot setbacks will be required at the southern limit of the building areas on these lots. This condition will be recorded against each property in a form to be approved by the City, and the setbacks indicated in the lot-specific design guidelines to ensure that future homeowners are advised against new construction in this setback zone.

5.3.6 Mitigation Measure: The current remedial work scheme allows the homes on Lots 8 and 9 to be constructed on unrepaired (although partially buttressed) active landslide deposits. The proposed remedial grading shall be extended to repair this entire landslide complex within the proposed development area due to the potential for some future movement of the materials within the building envelopes. It may also be necessary to construct a buttress around the entire upslope perimeter of Lot 9 to protect the home from sliding from upslope, rather than just the partial buttress currently shown near the southeastern upslope limit of this property. Prior to approval of the tentative subdivision map, additional site-specific design work shall be performed to the satisfaction of the City to address this issue. Any proposed mitigations shall be subject to the review and approval of the City Engineer and shall be incorporated into the tract improvement plans.

5.3.7 Mitigation Measure: The older active landslide present in the northwestern corner of the property extends across Lots 10 and 11 and the entire deposit should be defined as active. The lower extension of this landslide shown on Map 5-1 should be designated as an older active (or active) deposit, and should also be included on Map 5-2. This portion of the landslide extends through the

proposed building envelope on Lot 11. Prior to approval of the tentative subdivision map, further study shall be conducted by the developer regarding the possibility of and impacts of significant future movement in the northern portions of Lots 10 and 11, as well as the likelihood that this landslide complex will continue moving and damage the barn and home located immediately north of these lots on the adjacent property. If further study determines that this landslide could have significant future movement, and/or the landslide complex will continue moving and damage the barn and home, specific design measures will be provided that will address these instability problems, subject to the approval of the City. Said mitigations shall be incorporated in the development plans and tract improvement plans for the subdivision.

5.3.8 Mitigation Measure: Various portions of the recent landslide deposit which extends through Lots 10 and 11 have reactivated, including the two recent areas of failure immediately southwest of Lot 10. Prior to approval of the tentative subdivision map, additional analysis shall be performed to provide an assessment of the suitability of developing homes on Lots 10 and 11 under existing conditions. If such development is unsuitable, specific design measures will be provided prior to approval of the tentative subdivision map that will address these instability problems, subject to the approval of the City.

5.3.9 Mitigation Measure: The large area labeled older landslide within the northern hillside lots may also have future potential for movement based on the shear zones encountered the test pits in this area. Because of the weak and sensitive character of this material, at a minimum, a large buttress shall be constructed to protect the roadway as it traverses this area due to destabilization the roadway grading might otherwise cause. Prior to approval of the tentative subdivision map, further studies of the activity level of this material within the proposed building areas shall also be performed to determine if additional remedial work is needed to stabilize the shallow 10-foot deep slide plane identified in the test pits in this area. If necessary, specific design measures that will address these issues as determined by the City Engineer will be developed prior to approval of the tentative subdivision map.

5.3.10 Mitigation Measure: Grading within the hillside lots will be limited to no more than three feet of cut or fill. This shall be disclosed to potential buyers of each lot within the development and this restriction shall be included in the design guidelines. This disclosure statement shall be subject to the review and approval of the City Attorney and shall be presented for review prior to approval of the final subdivision map.

5.3.11 Mitigation Measure: All water collected within the building pads (including on structure roofs and paved surfaces) shall be transported to an approved storm drain system. No collected water shall be allowed to discharge onto project slopes. To accomplish this mitigation measure, an additional storm drain line extending near the northern property boundary or other mitigation acceptable to the City Engineer to properly discharge waters which are collected on Lots 10 through 13 may be necessary. The additional storm drain line shall be shown on the tract improvement plans.

5.3.12 Mitigation Measure: The project applicant shall perform detailed monitoring of the groundwater levels within the hillside area during the winter months, in order to determine whether there are any stability problems. The first such monitoring shall be completed by the developer and approved by the City prior to any grading in the hillside area. If it is determined that groundwater is a

potential problem, the developer shall propose mitigations subject to the review and approval of the City Engineer. These mitigations shall be incorporated into the development plan and tract improvement plans for the subdivision. Monitoring of groundwater levels within the hillside area during the winter months shall be incorporated into the Geologic Hazards Abatement District monitoring program.

C. Visual/Aesthetic Impacts (Chapter 6)

Impacts

1. Grading for building pads will introduce changes in topographic form and vegetation patterns in the landscape setting. The road that accesses Lots 5 through 13 is also of concern since it is perpendicular to many viewers' line of sight and it climbs in elevation. The homesites around the knoll at the end or this road will be very visible. **Grading for the 13 lots will result in a significant short-term visual impact.**

2. Extensive grading, re-contouring of the hillside and some removal of mature vegetation will occur for necessary landslide repairs. These landslide repair measures will create a short-term visual impact during the repairs. Until the re-vegetation grows over the landslide repair scars, there will be significant visual contrast between the natural hillside covered with mature vegetation and the slide repair areas.. **Grading due to landslide repair is considered a significant short-term impact.**

3. The principal long-term visual impact is the loss of scenic open space in the project area. A total of 13 new homes would be constructed. Since the majority of the lots are on the northern border of the Oak Tree Farm property, they will be most noticeable for residents living adjacent to and with a view of the site (i.e., those on Country Lane), and for motorists travelling along Foothill Road and Interstate 680. **Even with the mitigation measures that are part of the project, the loss of scenic open space is considered a significant impact.**

4. Some heritage trees[1] may be removed for site development and landslide repairs. Even if not removed, trees can also be damaged during grading and construction, or due to improper care once the project is completed. The Architectural and Landscape Design Guidelines include instructions for homeowners to ensure the preservation of heritage trees. The Heritage Tree Ordinance prescribes ways to preserve trees during grading

1 Per Section 17.16.006 of the Tree Preservation Ordinance, a "heritage tree" means any of the following: 1. Any single-trunked tree with a circumference of 55 inches or more measured 4.5 feet above ground level; 2. Any multi-trunked tree of which the 2 largest trunks have a circumference of 55 inches or more measured 4.5 feet above ground level; 3. Any tree 35 feet or more in height; 4. Any tree of particular historical significance specifically designated by official action; 5. A stand of trees the nature of which makes each dependent upon the other for survival or the area's natural beauty.

and construction, and imposes fines for unauthorized removal of trees. **Even with these measures that are part of the project, the loss of heritage trees would be considered a potentially significant impact.**

Mitigation Measures

4.3.1 Mitigation Measure: The applicant shall add a new section to the Architectural and Landscape Design Guidelines that specifically applies to Phase III of Oak Tree Farm. The section shall include all applicable mitigation measures, conditions of approval, and a map showing the location of the 13 lots.

6.3.1 Mitigation Measure: This mitigation measure is recommended to protect trees, natural open space and to limit the visual effects of grading: prior to approval of the tentative subdivision map for the 13 lots, the applicant shall be required to submit a map showing designated specific buildable areas for each lot. To the extent feasible, the buildable areas shall be sited to minimize heritage tree removal, preserve natural open space, and limit the visual effects of grading. The buildable areas shall also be sited to minimize views of the structures from off-site.

D. Noise (Chapter 7)

Impacts

1. The DNL varies from 63 to 65 dB at lots with line-of-sight to I-680. This measurement takes into account train passbys. The DNL is less at Lot 12 because there is significant acoustical shielding from the existing terrain. **Since the DNL for Lots 3, 5, 6, and 9 ranges from 63 dB to 65 dB, and the City goal for backyards of single-family homes is generally 60 dB, this is considered a significant adverse impact.**

2. Short-term noise from intermittent construction activities will occur as individual sites are developed. The large size of the lots and the project site will help to reduce the noise impacts. **These noise impacts are considered significant. The application of mitigation measures will reduce the level of these impacts to a less than significant level.**

Mitigation Measures

7.3.1 Mitigation Measure: If the major outdoor use area is located in front of the house (facing the freeway), adequate noise reduction can be achieved with a berm or fence (masonry or wood) which is just high enough to block the line-of-sight between the receivers in the back yard and the freeway. Because the residential lots are located above the freeway, this could be achieved with a fence of modest height (less than six feet), depending upon the actual geometry.

7.3.2 Mitigation Measure: Achieving the City's indoor noise criterion of DNL 45 dB will require the use of sound-rated windows in the closed position for some rooms. The appropriate sound ratings and locations should be determined by an acoustical consultant based on a review of the architectural

design of the homes. This analysis should also address the City's single-event indoor noise for train passbys.

7.3.3 Mitigation Measure: All grading and construction activities shall occur only during the hours proscribed in the City's current standard conditions of approval.

E. Vegetation and Wildlife (Chapter 8)

Impacts

1. Heritage trees that might be affected by road construction would be trees 245, 246 and 247, which are located in the northern portion of the site. Although these trees are not located within the proposed right-of-way, they may be subject to damage due to grading for the roads. **Mitigation measures from the Architectural and Landscape Design Guidelines which are part of the project, will reduce this potentially significant adverse impact to a less than significant level. These mitigation measures include protecting the roots of heritage trees; the presence of a qualified biologist during road grading activities; and replacement of removed trees at a six to one ratio.**

2. The development plan attempts to locate building envelopes away from stands of trees and individual heritage trees, especially on most hillside lots. Notable exceptions to this are Lots 5, 10 and 11. The building envelope indicated for Lot 11 lies partially within the dripline of a tree group. Most of the middle of Lot 10 is covered with a stand of trees, one of which is a heritage tree (#235, Coast Live Oak) located at the westerly property line. It seems impossible to place a home on this site without removal of some trees. However, removal of the trees will cause the lot and home to be quite visible. As some of the trees are located towards the rear of the site, removing them would create a clear view of the site from adjacent residences. Additionally, removing a number of trees which are part of a stand creates impacts throughout the remaining trees. **This is considered a significant, unavoidable adverse impact.**

3. At least 17 heritage trees, all but one of which are Coast or Valley Oak, would need to be removed. Substantial amounts of vegetation located at the toe of the hill slope would have to be removed. Much of this vegetation is located around the central ravine drainage and is of significance, as it provides wildlife habitat. **Removal of heritage trees and this vegetation is considered a significant, unavoidable adverse impact.**

4. The amount of vegetation removal indicated above assumes that the areal extent of landslide repairs is not extended during further geotechnical investigations or field repair work. As part of the mitigation of impacts related to geology, the area indicated on Map 5-2 for buttressing, excavation and recompaction may become larger, which could affect more trees and vegetation. If additional heritage trees would be removed, almost all vegetation along the toe of the slope would be removed, and the symbiotic integrity of large stands of trees would be jeopardized. **The potential for removal of**

substantial additional amounts of vegetation is considered a potentially significant environmental impact.

5. Direct and indirect impacts to wildlife would occur primarily as a result of habitat loss. Various wildlife species are associated with each of the vegetation communities. Direct impacts would include the loss of food sources. For example, the main food source of the gray squirrel--oak acorns--would be reduced through removal of coast live oak woodland. Gray squirrels would subsequently be either displaced or eliminated from the project site. Indirect impacts on predators also would occur because of the reduced opportunity for preying on organisms found in either coast live oak woodland or grassland. Predatory wildlife species including red-tailed hawk and coyote, likely would be displaced to nearby hunting areas, or reduced in number because of reduced numbers of prey.

   Indirect impacts on the remaining undisturbed habitat and associated wildlife would result from the intrusive presence of future residents and structures around and within the undeveloped portions of the site. Native wildlife species are impacted when domestic cats and dogs chase or prey on them. **Habitat loss and reduction of on-site wildlife is considered a potentially significant impact.**

<u>Mitigation Measures</u>

4.3.1 Mitigation Measure: The applicant shall add a new section to the Architectural and Landscape Design Guidelines that specifically applies to Phase III of Oak Tree Farm. The section shall include all applicable mitigation measures, conditions of approval, and a map showing the location of the 13 lots.

2.5 Significant and Unavoidable Adverse Impacts

If the above mitigation measures are implemented, there will still be significant and adverse impacts from the project. These include visual impacts, impacts to heritage trees, removal of substantial amounts of vegetation, habitat loss and reduction of on-site wildlife. While some identified impacts would be relatively insignificant alone, they will contribute to cumulative habitat loss, scenic open space loss, and cumulative increases in noise levels.

2.6 Summary of Alternatives

Alternatives discussed in the report include: (1) a No Project Alternative; (2) Reduced Number of Lots Alternative #1; and (3) Reduced Number of Lots Alternative #2. Each is briefly summarized below.

(1) No Project Alternative – In this case, the No Project Alternative, which is required by CEQA, would be no construction of the 13 single-family homes that constitute Phase III of the Oak Tree Farm subdivision. Only the 38 units from Phases I and II would be constructed, and the rest of the site would remain vacant. Although the No Project Alternative is environmentally superior to the proposed project, it would likely be a temporary condition, since the site is designated in the General

Plan for Rural and Low Density Residential uses, which means that more than 38 units would be permitted on the site. In addition, market demands and development pressure would probably result in another development proposal, at some time.

(2) Reduced Number of Lots Alternative #1– With this alternative, lots 7 through 11 would be eliminated from the site plan, reducing the total number of lots for Phase III from 13 to 8. This would be an environmentally superior alternative, since it would require less disturbance of the natural terrain, create less of a visual impact from off-site, alleviate noise impacts on residents at Oak Tree Farm, and create less of an impact on vegetation and wildlife.

(3) Reduced Number of Lots Alternative #2 – With this Alternative, Lots 1 through 4 would be eliminated from the site plan, reducing the total number of lots in Phase III from 13 to 9. This would be an environmentally superior alternative, since it would involved less disturbance of the natural terrain, create less of a visual impact off-site, and create less of an impact on vegetation and wildlife.

All of the alternatives seem to be environmentally superior to the proposed project. The Reduced Lots Alternatives conform to established General Plan policies regarding visual sensitivity and reduced geologic hazards.

2.7 Areas of Controversy and Issues to be Resolved

The primary area of controversy involves the geotechnical analyses for the hillside portion of the site. The most recent analyses have been included in this SEIR.

Issues to be resolved include the choice among alternatives.

2.8 Summary of Mitigation Monitoring Recommendations

Section 21081.6 of the Public Resources Code requires all agencies approving a project for which mitigation measures were adopted to avoid significant effects on the environment, to adopt a mitigation monitoring program. The program should, at a minimum, identify the following:

1. What is the mitigation measure, what needs to be monitored and how?
2. Who is responsible for implementing the mitigation?
3. What department or agency is responsible for monitoring the mitigation?
4. What schedule is required to provide adequate monitoring?
5. What indicates the monitoring and mitigation as complete?

Table 2-1 presents a master mitigation monitoring checklist. This table may need to be revised depending upon the mitigation measures adopted by the City of Pleasanton. The revised table should be completed prior to the second reading of the ordinance approving the project development plan and rezoning.

TABLE 2-1
SUMMARY OF MITIGATION MONITORING RECOMMENDATIONS

Issue Area	Mitigation Measure	Who Implements Mitigation	When Monitoring is Implemented	When Mitigation Completed	Who Verifies Mitigation
Land Use And Planning (Chapter 4)	**4.3.1 Mitigation Measure:** The applicant shall add a new section to the Architectural and Landscape Design Guidelines that specifically applies to Phase III of Oak Tree Farm. The section shall include all applicable mitigation measures, conditions of approval, and a map showing the location of the 13 lots.	Developer	Prior to tentative map Approval	Prior to final Map approval	Pleasanton Planning Department
Geology (Chapter 5)	**5.3.1 Mitigation Measure:** Any structures and improvements constructed on the slope of any landslide shall have flexible utility connections to accommodate ground movement during an earthquake.	Developer; Individual Homeowner	At time of construction	After City inspects and approves installation	Pleasanton Public Works Department
	5.3.2 Mitigation Measure: In terms of the ancient landslide, during a major earthquake, deformation of the landslide materials may occur. To accommodate this potential deformation, the foundations for all structures on Lots 1 through 13 shall be designed and reinforced to withstand a landslide deformation during a major earthquake. In addition, the street pavement and utility lines shall be designed to take into account a total differential movement of nine inches over 800 feet, which translates into a compressive strain of 0.1 percent.	Developer; Individual Homeowner	At time of construction	After City inspects and approves each installation	Pleasanton Public Works Department
	5.3.3 Mitigation Measure: The remedial work for both active, older active, and recent landslides shall be similar, because the older active landslides have nearly the same potential for future movements as the active landslides, and because many of the so-called recent landslides may also have significant potential for future activity.	Developer	Studies completed Prior to Tentative Map Approval	Remedial work completed after City inspects and approves	Pleasanton Public Works Department
	5.3.4 Mitigation Measure: The currently proposed buttress for Lots 1 through 4 may not be of sufficient size to restrain the very large landslide complex which extends upslope and beyond the limits of the project site. The current layout of the lots as shown on Map 5-1 do not appear to have adequate mitigation by the conceptual buttress shown on the map. Prior to approval of the tentative subdivision map, additional site-specific design work shall be performed to the satisfaction of the City to address this issue.	Developer	Studies completed Prior to Tentative Map Approval	Remedial work completed after City inspects and approves	Pleasanton Public Works Department
	5.3.5 Mitigation Measure: For Lots 7 and 9, 30-foot setbacks will be required at the southern limit of the building areas on these lots. This condition will be recorded against	Developer; Individual Homeowner	Prior to tentative map approval	After City inspects and approves each installation	Pleasanton Public Works Department

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TABLE 2-1 (Continued)

Issue Area	Mitigation Measure	Who Implements Mitigation	When Monitoring is Implemented	When Mitigation Completed	Who Verifies Mitigation
	each property in a form to be approved by the City, and the setbacks indicated in the lot-specific design guidelines to ensure that future homeowners are advised against new construction in this setback zone.				
	5.3.6 Mitigation Measure: The current remedial work scheme allows the homes on Lots 8 and 9 to be constructed on unrepaired (although partially buttressed) active landslide deposits. The proposed remedial grading shall be extended to repair this entire landslide complex within the proposed development area due to the potential for some future movement of the materials within the building envelopes. It may also be necessary to construct a buttress around the entire upslope perimeter of Lot 9 to protect the home from sliding from upslope, rather than just the partial buttress currently shown near the southeastern upslope limit of this property. Prior to approval of the tentative subdivision map, additional site-specific design work shall be performed to the satisfaction of the City to address this issue. Any proposed mitigations shall be subject to the review and approval of the City Engineer and shall be incorporated into the tract improvement plans.	Developer	Prior to approval of final map	After City inspects and approves	Pleasanton Public Works Department
	5.3.7 Mitigation Measure: The older active landslide present in the northwestern corner of the property extends across Lots 10 and 11 and the entire deposit should be defined as active. The lower extension of this landslide shown on Map 5-1 should be designated as an older active (or active) deposit, and should also be included on Map 5-2. This portion of the landslide extends through the proposed building envelope on Lot 11. Prior to approval of the tentative subdivision map, further study shall be conducted by the developer regarding the possibility of and impacts of significant future movement in the northern portions of Lots 10 and 11, as well as the likelihood that this landslide complex will continue moving and damage the barn and home located immediately north of these lots on the adjacent property. If further study determines that this landslide could have significant future movement, and/or the landslide complex will continue	Developer	Studies Completed Prior to Tentative Map Approval	Remedial work completed after City inspects and approves	Pleasanton Public Works Department

TABLE 2-1 (Continued)

Issue Area	Mitigation Measure	Who Implements Mitigation	When Monitoring is Implemented	When Mitigation Completed	Who Verifies Mitigation
	moving and damage the barn and home, specific design measures will be provided that will address these instability problems, subject to the approval of the City. Said mitigations shall be incorporated in the development plans and tract improvement plans for the subdivision.				
	5.3.8 Mitigation Measure: Various portions of the recent landslide deposit which extends through Lots 10 and 11 have reactivated, including the two recent areas of failure immediately southwest of Lot 10. Prior to approval of the tentative subdivision map, additional analysis shall be performed to provide an assessment of the suitability of developing homes on Lots 10 and 11 under existing conditions. If such development is unsuitable, specific design measures will be provided prior to approval of the tentative subdivision map that will address these instability problems, subject to the approval of the City.	Developer	Prior to approval of final map	After City inspects and approves	City of Pleasanton Public Works Department
	5.3.9 Mitigation Measure: The large area labeled older landslide within the northern hillside lots may also have future potential for movement based on the shear zones encountered the test pits in this area. Because of the weak and sensitive character of this material, at a minimum, a large buttress shall be constructed to protect the roadway as it traverses this area due to destabilization the roadway grading might otherwise cause. Prior to approval of the tentative subdivision map, further studies of the activity level of this material within the proposed building areas shall also be performed to determine if additional remedial work is needed to stabilize the shallow 10-foot deep slide plane identified in the test pits in this area. If necessary, specific design measures that will address these issues as determined by the City Engineer will be developed prior to approval of the tentative subdivision map.	Developer	Prior to approval of final map	After City inspects and approves	City of Pleasanton Public Works Department

TABLE 2-1 (Continued)

Issue Area	Mitigation Measure	Who Implements Mitigation	When Monitoring is Implemented	When Mitigation Completed	Who Verifies Mitigation
	5.3.10 Mitigation Measure: Grading within the hillside lots will be limited to no more than three feet of cut or fill. This shall be disclosed to potential buyers of each lot within the development and this restriction shall be included in the design guidelines. This disclosure statement shall be subject to the review and approval of the City Attorney and shall be presented for review prior to approval of the final subdivision map.	Developer	Prior to final map approval	After City inspects and approves	City of Pleasanton Public Works Department
	5.3.11 Mitigation Measure: All water collected within the building pads (including on structure roofs and paved surfaces) shall be transported to an approved storm drain system. No collected water shall be allowed to discharge onto project slopes. To accomplish this mitigation measure, an additional storm drain line extending near the northern property boundary or other mitigation acceptable to the City Engineer to properly discharge waters which are collected on Lots 10 through 13 may be necessary. The additional storm drain line shall be shown on the tract improvement plans.	Developer	Prior to final map approval	After City inspects and approves	City of Pleasanton Public Works Department
	5.3.12 Mitigation Measure: The project applicant shall perform detailed monitoring of the groundwater levels within the hillside area during the winter months, in order to determine whether there are any stability problems. The first such monitoring shall be completed by the developer and approved by the City prior to any grading in the hillside area. If it is determined that groundwater is a potential problem, the developer shall propose mitigations subject to the review and approval of the City Engineer. These mitigations shall be incorporated into the development plan and tract improvement plans for the subdivision. Monitoring of groundwater levels within the hillside area during the winter months shall be incorporated into the Geologic Hazards Abatement District monitoring program.	Developer	Prior to final map approval	After City inspects and approves	City of Pleasanton Public Works Department
Visual/ Aesthetic (Chapter 6)	**6.3.1 Mitigation Measure:** This mitigation measure is recommended to protect trees, natural open space and to limit the visual effects of grading: prior to approval of the tentative subdivision map for the 13 lots, the applicant shall be required to	Developer	Prior to tentative map approval	Prior to final map approval	Pleasanton Planning and Public Works Departments

TABLE 2-1 (Continued)

Issue Area	Mitigation Measure	Who Implements Mitigation	When Monitoring is Implemented	When Mitigation Completed	Who Verifies Mitigation
	submit a map showing designated specific buildable areas for each lot. To the extent feasible, the buildable areas shall be sited to minimize heritage tree removal, preserve natural open space, and limit the visual effects of grading. The buildable areas shall also be sited to minimize views of the structures from off-site.				
Noise (Chapter 7)	**7.3.1 Mitigation Measure:** If the major outdoor use area is located in front of the house (facing the freeway), adequate noise reduction can be achieved with a berm or fence (masonry or wood) which is just high enough to block the line-of-sight between the receivers in the back yard and the freeway. Because the residential lots are located above the freeway, this could be achieved with a fence of modest height (less than six feet), depending upon the actual geometry.	Developer and Individual lot Owner	Prior to tentative map approval	Prior to building permit approval	Pleasanton Planning and Building Departments
	7.3.2 Mitigation Measure: Achieving the City's indoor noise criterion of DNL 45 dB will require the use of sound-rated windows in the closed position for some rooms. The appropriate sound ratings and locations should be determined by an acoustical consultant based on a review of the architectural design of the homes. This analysis should also address the City's single-event indoor noise for train passbys.	Developer and Individual Lot Owner	Prior to approval of building plans	After City occupancy inspection	Pleasanton Planning and Building Departments
	7.3.3 Mitigation Measure: All grading and construction activities shall occur only during the hours proscribed in the City's current standard conditions of approval.	Developer; Contractors	During construction	When construction is complete	Ciliate of Pleasanton Public Works Deportment
Vegetation and Wildlife (Chapter 8)	Refer to Mitigation Measure 4.3.1 in the Land Use and Planning Chapter.	Developer	Prior to tentative map approval	Prior to final map approval	Pleasanton Planning Department

CHAPTER 3: PROJECT DESCRIPTION

The applicant, Currin Construction Company, is requesting approval of a 13-lot subdivision on 13.5 acres of a 91-acre site that comprises the Oak Tree Farm residential subdivision. The 13-lot subdivision is Planned Unit Development (PUD)-97-01, which is Phase III (the final phase) of the Oak Tree Farm residential subdivision.

3.1 Project Location

The project site (Oak Tree Farm, 8015 Foothill Road), is located on the southwestern edge of the City of Pleasanton, on the eastern lower flank of the Pleasanton Ridge (see Map 3-1). The site is located south of the Castlewood Country Club development and across Foothill Road from Verona Bridge (see Map 3-2). Several miles of agricultural and open space lands separate this residential area from the village of Sunol to the south. The Castlewood development also separates the project site from the rest of Pleasanton to the north.

3.2 Background and Major Objectives of the Project

In 1992, the Pleasanton City Council certified an SEIR and approved a PUD for a 55-lot subdivision called Oak Tree Farm. The subdivision is located on the west side of Foothill Road, south of the Castlewood Country Club and adjacent to the East Bay Regional Park District's Pleasanton Ridge Regional Park. One of the requirements of the SEIR and the PUD conditions of approval called for further geotechnical studies prior to any City approvals of the project's tentative subdivision map. At the time of the tentative subdivision map review, the City determined that the hillside area of the site, for which 17 lots were proposed, had not been demonstrated to be stable to the satisfaction of the City Council or the City's reviewing geologist. Consequently, the 17 lots were eliminated from the tentative subdivision map. The remaining 38 lots, which are Phase I and Phase II of Oak Tree Farm, have recorded final subdivision maps and construction of single-family custom homes is occurring.

During 1996, the applicant conducted further geotechnical studies for the 17 lots. The results of these studies have been reviewed by a peer reviewing geologist selected by the City. The new studies indicate that the hillside area can be made stable, with the implementation of specific mitigation measures. In addition, the applicant has reduced the number of proposed lots from 17 to 13, for a total of 51 lots in the subdivision. The location of these 13 lots is shown on Map 3-3.

Because this new geotechnical information is significantly different from that presented in the 1992 SEIR and other published documents, the City will recirculate relevant portions of the 1992 SEIR with the new information in this Supplemental EIR (SEIR).

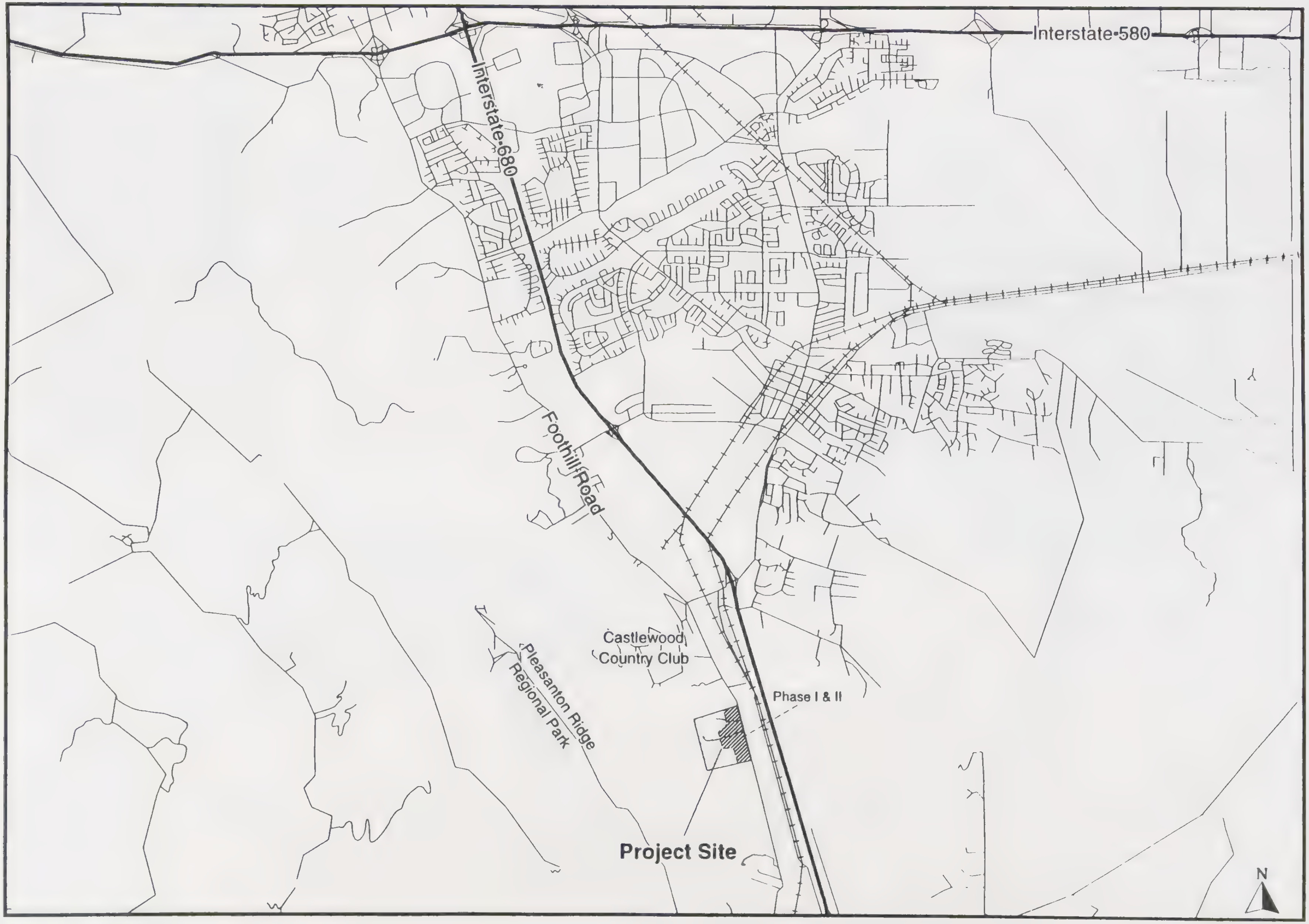
3.3 Major Features of the Project

The project that is the subject of this SEIR is a 13-lot subdivision (PUD-97-01, Phase III-the final phase) of the Oak Tree Farm residential subdivision. The applicant proposes to construct 13 single-family detached custom homes on the 13 lots. The Oak Tree Farm residential subdivision is the

REGIONAL LOCATION
Oak Tree Farm
Phase III
PUD-97-01

Map 3-1

Scale: 1in.= 3.78mi.
Source: Mapinfo



CITY SETTING
Oak Tree Farm
Phase III
PUD-97-01

Map 3-2

Scale: 1in.= 1.08mi.
Source: Mapinfo

KatzHollis

PROJECT SITE
Oak Tree Farm
Phase III
PUD-97-01

Map 3-3
Not to Scale
Source: Lynn Bowers & Associates

subject of the *Oak Tree Farm (PUD 89-17) Draft Supplemental Environmental Impact Report (SCH#90030991)* (October 1991) and *Final Supplemental Environmental Impact Report* (January 1992). These two documents are incorporated into this SEIR by reference and are available for public inspection at the Department of Planning and Community Development at 200 Old Bernal Avenue in Pleasanton.

3.4 Project Approvals

The following approvals and actions would be necessary prior to implementation of the project.

- Final SEIR Certification: The Final SEIR must be certified by the City Council as accurate and complete. The Final SEIR includes responses to comments received on this Draft SEIR. The certification of the Final SEIR does not constitute approval of the project, but indicates that all required environmental information regarding the project has been presented to the Pleasanton decision-makers and the public.

- Findings: If there are significant impacts that cannot be mitigated to a less than significant level, Findings of Fact and Statement of Overriding Considerations must be approved by the City, explaining how each significant adverse environmental impact and each project alternative has been addressed in the Final SEIR. These findings must be approved prior to the first discretionary action on the proposed project. In this case, the first discretionary action would be that of the Planning Commission.

- Mitigation Monitoring Plan: If there are significant impacts, a mitigation monitoring plan must be approved by the City in conjunction with approval of the findings. Such a plan identifies a comprehensive approach to implement the mitigation measures recommended in the SEIR. This Plan addresses which agencies are to monitor which mitigation measures, and within what time period such measures are to be undertaken.

  Development Plan: The City must approve the proposed Planned Unit Development (PUD), making the necessary findings for approval as required by the City of Pleasanton Municipal Code, Section 18.68. Approval of the project may be conditioned by the City.

  Tentative Subdivision Map: The Planning Commission must approve the tentative subdivision map for the project.

  Final Subdivision Map: The City Council must approve the final subdivision map for the project.

3.5 Related Projects

Section 15130 of the CEQA Guidelines requires that an EIR address the impacts of the proposed project plus "past, present, and reasonably anticipated future projects producing related or cumulative impacts." For the purposes of this Supplemental EIR, related projects are those analyzed in the October 1991 Draft Supplemental EIR for the entire subdivision.

3.6 Relationship to Local Plans

The General Plan

The General Plan land use designations for the site are PUD-Rural Density Residential (1 unit for every 5 acres), and PUD-Low Density Residential (less than 2 units per acre). The proposed project conforms with these density standards. The number of lots already approved (38) and the 13 lots that are the subject of this SEIR together conform to the overall allowable density for the site. Amenities have been included as part of the project so that it is in conformance with General Plan policies.

The Zoning Code

The zoning designations for the site are PUD-Rural and Low Density Residential. The proposed project is consistent with these designations.

The West Foothill Road Corridor Overlay District (WFRCOD)

The project site is within the WFRCOD, which stipulates development and design standards for residential developments proposed for properties on the west side of Foothill Road. However, when the City Council approved PUD-89-17 (Phases I and II), it allowed a relaxation of some of these standards due to the site's unusually flat topography along Foothill Road and the topographical constraints of the hill. Other standards intended to reduce the project's visual impacts and maintain a "rural" character were implemented through the requirement for approval of lot-by-lot design guidelines for all 54 lots that were originally approved as the PUD, plus the existing house for a total of 55 lots. The other standards include: height limits; unit size limits; split pad lot designs; grading limitations, etc.

CHAPTER 4: LAND USE AND PLANNING

This chapter evaluates the proposed residential Planned Unit Development (PUD) in relation to local land use and planning issues, including its consistency with the City's General Plan, the City's Zoning Code, conformance with the West Foothill Road Corridor Overlay District (WFRCOD) and compatibility with surrounding properties.

Background

The *City of Pleasanton General Plan*, adopted August 6, 1996, identifies the project site as Planned Unit Development (PUD) Low Density Residential (less than 2 units per acre) and PUD Rural Density Residential (1 unit for every 5 acres). The PUD designation is intended for residential properties which have unusual topography and/or other characteristics which do not lend themselves to development under standard zoning, and/or that possess unique features.

According to the *Pleasanton Zoning Code*, the project site is zoned PUD as well.

The site is also zoned as part of the *West Foothill Road Corridor Overlay District* (WFRCOD). This zoning ordinance was adopted by the City Council in July, 1990 and sets development and design standards for residential developments proposed for properties on the west side of Foothill Road. The WFRCOD was adopted to reduce visual impacts of residential development on the west side of Foothill Road. The *Oak Tree Farm Architectural and Landscape Design Guidelines* of August 25, 1992 are in part intended to implement the goals of the WFRCOD, that is, to maintain the aesthetic, rural character of the Foothill Road corridor, as well as providing opportunities for custom homes, recreation, open space and preservation of the City's most visible resource. These design guidelines are to be used for all three development phases at Oak Tree Farm.

4.1 EXISTING SETTING

Existing Land Use

The 13 lots on 13.5 acres that are the subject of this SEIR are vacant and undeveloped, although there is a paved street that accesses these lots and streetlights have been installed. Of the remaining 77.5 acres that comprise the Oak Tree Farm subdivision, 44 acres that are part of the hillside portion of the site are in a conservation easement. The rest has been divided into 37 lots[2], and single-family custom homes are either in the process of being constructed, or will be constructed on these lots over the next several years.

Surrounding Land Uses and Development Plans

North of Oak Tree Farm, on both sides of Foothill Road, are large single-family homes on lots of at least 35,000 square feet along Oak Lane, Country Lane and the east side of Foothill Road. The

2 Note that PUD-89-17 ultimately approved subdivision of the project site into 38 lots, including the existing house. Therefore, a total of 37 new homes were approved for PUD-89-17.

Castlewood Country Club is located north of Oak Lane. Castlewood Country Club has numerous dwellings on one-half to one-acre lots surrounding an 18 hole golf course. The Oak Lane and Castlewood neighborhoods are characterized by winding, narrow roads, with homes hidden among the vegetation or located on cul-de-sacs. Both of these developments have mature vegetation. A second 18 hole golf course is located on the east side of Foothill Road and on either side of Castlewood Drive.

Across Foothill Road from Oak Tree Farm on the east is a nine-lot subdivision. Each of these lots is at least 40,000 square feet. Still further south along Foothill Road, the City of San Francisco Water Department owns a 106-acre parcel that stretches from Verona Road south along the Arroyo for almost a mile. This property is presently undeveloped and heavily wooded.

South and west of Oak Tree Farm the lands between the project site and Sunol are mainly undeveloped open space and park land. Ridgelands Regional Park, operated by the East Bay Regional Park District (EBRPD), borders the site to the south and west. This 1,700-acre park includes the upper slopes of the Pleasanton Ridge from the City's Augustine Bernal Park southward, and includes approximately 5,000 lineal feet of frontage along the west side of Foothill Road to the south of Oak Tree Farm.

4.2 IMPACT ANALYSIS

Criteria of Significance

According to Appendix G (Significant Effects) of the CEQA Guidelines, a project will normally have a significant effect if it will conflict with the adopted land use policies of the community where it is located or with policies of other responsible agencies. For purposes of this SEIR, implementation of the project would also create a significant environmental impact if it would result in incompatibility between land uses, safety or nuisance impacts, significant public services or facility demands, or urban sprawl.

Consistency with General Plan Map and Policies

Land Use Consistency. Lands to the north of the site are designated Low Density Residential and Parks and Recreation (Castlewood Country Club Golf Course). To the south and immediately adjacent on the west, land is designated as Parks and Recreation. Properties further west generally are designated as Agriculture and Grazing, with a Public Health and Safety "overlay" in some areas with elevations of 670 feet or higher. The arroyo to the east across Foothill Road carries a Public Health and Safety designation with a Wildlands "overlay", and beyond the arroyo, land is designated as Parks and Recreation.

The project site has a General Plan designation of Planned Unit Development (PUD) Low Density Residential and PUD Rural Density Residential. Lots 1 through 4 are within the Low Density land use designation, while lots 5 through 13 are within the Rural Density land use designation. The General Plan permits clustering of homes on lots of one-half acre in the Rural Density Residential areas. In addition, General Plan policies provide for density transfer within a site, provided that the overall density for the entire site does not exceed the overall maximum. The site plan shifts some

units out of the Rural Density Residential areas and locates them on lots within the Low Density Residential portions of the site. The General Plan permits such flexibility within the confines of a site. Therefore, there is no inconsistency created by a slight mismatch of density between the proposed development plan and the General Plan Land Use Map. The proposed project, in the context of the entire Oak Tree Farm project, is consistent with the density allowances identified by the General Plan for this site. **Therefore, impacts related to land use consistency with the General Plan are less than significant, and no mitigation measures are required or recommended.**

Density Consistency. The General Plan allows for up to 91 dwelling units on the site, assuming that the maximum allowable density would be permitted. However, General Plan policy states that the City should attempt to achieve average densities on a city-wide basis. In addition, while the General Plan theoretically would allow up to 91 units on the site, General Plan policy also indicates that development of a particular site may be limited in areas where slopes exceed 25 percent, or where landslide or other hazards may make it infeasible to develop property according to the designated densities. The project site is constrained by slopes which exceed 25 percent and by landslides. Therefore, much of the 50-acre hillside portion of the site is not suitable for development. Although density transfer permitted by the General Plan could permit the construction of all the 91 units on the non-hillside portion of the site, such development would be inconsistent with surrounding land uses. Consequently, the development plan is limited to the average density of up to 51 units, allowing for proper location of units out of steep and/or hazardous areas. PUD-89-17 allowed for a total of 55 units (including the one existing house on the site), although only 38 units (including the one existing house on the site) were approved for development under the tentative subdivision map. PUD-97-01 is proposed for a total of 13 units, which brings the total for Oak Tree Farm to 51 units. **Since the proposed density is consistent with what is permitted, impacts are considered less than significant, and no mitigation measures are required or recommended.**

Consistency with General Plan Hillside Development Policies. The following policy and programs are from the General Plan Public Safety Element and are relevant to the proposed project.

Policy 6: Restrict new development of sites with structures intended for human occupancy in any landslide prone area and indicated as "Moderate" through "High" hazard for any geologic zone.

(According to Figure V-2 in the Public Safety Element of the General Plan, the project site is in a landslide prone area and is indicated as a "Moderate" hazard.) The following Public Safety Element programs apply to the proposed project.

Program 6.2: Permit development in landslide-prone areas identified as "Moderate" and "Moderate to High" only when site specific geologic and soils investigations demonstrate that geologic hazards can be mitigated. Sites must be shown to be stable during adverse conditions such as saturated soils, groundshaking, and during grading of the site for roads, installation of infrastructure, and creation of building pads. Engineering studies shall demonstrate that structures in landslide prone areas would sustain no more damage due to slope instabilities than damage sustained by a similar building in the Pleasanton Planning Area constructed to current UBC standards and located on soils with a low susceptibility to failure when exposed to moderate groundshaking.

Program 6.3: Require developers to include drainage, erosion, and landslide mitigation measures to reduce landslide potential.

Program 6.4: Design irrigation systems to minimize the potential for soil saturation, excessive run-off, and other factors deemed to contribute to slope instability.

Program 6.5: Design grading plans to minimize earth moving activity and site grading in areas of potential land instability and in areas identified as having a "Moderate" through "High" landslide potential.

All of these programs have been incorporated into the Conditions of Approval for PUD-89-17, and site-specific geologic investigations have been conducted in accordance with Program 6.2. Refer to Conditions of Approval numbers 55 through 59 and 60 through 80 in Chapter 5. Since these conditions are a part of the project, the project is considered consistent with General Plan hillside development policies, although additional mitigation measures related to development of the hillside that were included in subsequent geotechnical studies of the site are included in Chapter 5 of this EIR.

Conditions of Approval for PUD-89-17

The Conditions of Approval for PUD-89-17 include the following conservation easement requirements for the 44-acre hillside portion of the site. These conditions also apply to PUD-97-01, and are considered a part of the project (note that the numbers below are the number of the condition in the Conditions of Approval for PUD-89-17):

"9. The developer shall grant to the City a conservation easement over the 44-acre hillside portion of the site (Lot A). This easement shall indicate that no additional development is permitted on the undeveloped hillside portion of the property, and that the open space is to be maintained in perpetuity, in accordance with General Plan policies and land use designations.

10. The conservation easement shall indicate that the property owner of Lot A/developer may construct an equestrian facility which includes, but is not limited to: horse stables, riding ring(s), turn-out paddocks, other farm-related structures (for storage of feed, bedding, equipment, etc.), parking areas and an access road which may lead from the private driveway extending past Lot A. These facilities are subject to environmental review and approval by the City through an application for a major modification to the PUD, prior to any grading, vegetation removal, run-off diversion, or construction in anticipation of such facilities.

11. The developer/property owner of Lot A shall grant an access easement which traverses the hillside open space portion of the site. This access shall grant pedestrian/equestrian right-of-trail access to the residents of the Oak Tree Farm development. Additionally, the developer/property owner of Lot A shall grant first right of refusal for use of the equestrian facility to each resident of the Oak Tree Farm development.

12. The developer shall prepare an open space management program for the hillside open space area prior to tentative map approval. The management mechanism shall provide for continued maintenance of emergency vehicles access roads, fencing at the property boundaries and at the residential/open space boundaries. It shall indicate levels of maintenance required, and propose precise boundaries for land and easement dedication, and emergency vehicles access rights-of-way through the open space. This management program shall be administered by the owner of Parcel A."

Holding Capacity Consistency. The General Plan provides that the City shall attempt to achieve average densities on a Citywide basis to insure that traffic, noise, and air pollutant projections stay within the estimated limits indicated in the General Plan. Applying that criteria to the entire Oak Tree Farm site, the project's average overall holding capacity is 51 units. This is consistent with the total number of units provided as part of Phases I, II, and III of the project. **Therefore, impacts are considered less than significant, and no mitigation measures are required or recommended.**

Other General Plan Policies. The General Plan states that the policies need to be considered together with the Land Use Map to assess the City's intentions for future development and conservation within the community. The policies in one element are intended to be compatible with the policies in all other elements of the General Plan. The physical design of the site must be evaluated according to those policies in the Land Use, Circulation, Housing, Conservation and Open Space, Noise, Air Quality, and Public Safety Elements of the General Plan as they relate to new development in the City. The evaluations indicate that the project, as proposed, essentially is consistent (or consistent with mitigation measures included as part of the project or recommended elsewhere in the SEIR) with these General Plan policies. **Therefore, impacts are considered less than significant, and no mitigation measures are required or recommended.**

On-Site/Off-Site Land Use Compatibility.

<u>With Existing On-Site Uses</u>: Phases I and II of the Oak Tree Farm subdivision provide for the construction of 37 single-family custom homes. There is also one existing residence on the property. The addition of 13 additional units to the property would create noise and traffic impacts on the other homes, but this impact would not exceed that usually associated with residential subdivisions. The development of the site with residential uses would be compatible with the existing residential unit and the 37 new units. **Therefore, impacts are considered less than significant, and no mitigation measures are required or recommended.**

<u>With Existing Off-Site Uses</u>: The project site plan proposes 4 lots (lots 10 - 13) along the northern property line, with rear yards adjacent to existing rear yards of homes along Country Lane. The graded building envelope proposed for these lots is a minimum of 50 feet away from the property line. The potential pad elevations of these lots are approximately 20 feet above the average pad elevations of the homes on Country Lane. The potential visual impacts of these proposed lots on those of Country Lane are discussed in Chapter 6. The average lot size of the proposed lots (40,000 square feet) is equal to the minimum lot size of 40,000 square feet of the homes on Country Lane (NOTE: The actual size of the Country Lane lots is smaller due to street dedications). The lot size and the proposed land use of single-family residential uses are compatible with immediately adjacent residential land uses.

Across Foothill Road to the east, the County of Alameda granted approval of a nine-lot subdivision with minimum lot sizes of 40,000 square feet, which is currently underway. These lots are oriented toward Foothill Road. The building envelopes of the project's proposed lots maintain an average distance of 80 feet from the edge of Foothill Road. Given the spatial and visual buffering included in the project, the proposed residential use would be compatible with the proposed residential use along the east side of Foothill Road. **Therefore, impacts are considered less than significant, and no mitigation measures are required or recommended.**

Consistency with Zoning Ordinances and Development Standards

The project site is zoned as Planned Unit Development (PUD). In addition, the site is zoned as part of the West Foothill Road Corridor Overlay District (WFRCOD). The WFRCOD sets development and design standards for residential developments proposed for properties on the west side of Foothill Road. As mentioned in the Background section of this chapter, the *Oak Tree Farm Architectural and Landscape Design Guidelines* of August 25, 1992 are in part intended to implement the goals of the WFRCOD, that is, to maintain the aesthetic, rural character of the Foothill Road corridor, as well as providing opportunities for custom homes, recreation, open space and preservation of the City's most visible resource. In addition, the WFRCOD guidelines are included in the Architectural and Landscape Design Guidelines as an appendix. These design guidelines are to be used for all three development phases at Oak Tree Farm.

When the City Council approved PUD-89-17 (Phases I and II), it allowed a relaxation of some of these standards due to the site's unusually flat topography along Foothill Road and the topographical constraints of the hill. Other standards intended to reduce the project's visual impacts and maintain a "rural" character were implemented through the requirement for a approval of lot-by-lot design guidelines for all 51 lots of the PUD. The other standards include: height limits; unit size limits; split pad lot designs; grading limitations, etc. These standards are all included in the *Oak Tree Farm Architectural and Landscape Design Guidelines*.

Therefore, while the proposed project is not entirely consistent with the WFRCOD, mitigation measures have been developed that are consistent with the intent of the WFRCOD. Therefore, impacts will be less than significant, and no mitigation measures are required or recommended, other than those that are already part of the project.

Conditions of Approval for PUD-89-17

Additional Conditions of Approval for PUD-89-17 included in the Architectural and Landscape Design Guidelines that relate to Land Use and Planning are listed below (note that the numbers below are the number of the condition in the Conditions of Approval for PUD-89-17). These measures are considered part of the proposed project:

"13. The development shall prepare an open space management program for the open space areas along Foothill Road and common landscape areas (such as street median islands) prior to tentative map approval. The management mechanism shall provide for continued maintenance of the open space areas in perpetuity, weed abatement, enforcement of CC&Rs prohibiting construction, etc. within the open space areas, and for continued maintenance of landscape areas to the satisfaction of the City.

The program shall indicate levels of maintenance of landscape areas to the satisfaction of the City. The program shall indicate levels of maintenance required and shall be administered by the Landscaping and Lighting District.

14. The project applicant shall prepare specific guidelines for the open space easement areas and for the properties abutting them. These guidelines shall be incorporated into the Oak Tree Farm Landscape Guidelines prior to approval of the tentative map. CC&Rs shall be prepared to the satisfaction of City staff, indicating the responsibilities of each property owner regarding improvement and maintenance of these "scenic easement areas." Scenic easement areas shall be clearly indicated on the tentative subdivision map, prior to approval. All easements and restrictions shall be recorded on the deed to the affected properties, to the satisfaction of the City Attorney."

4.3 MITIGATION MEASURES

In order to ensure that mitigation measures that are included in the *Oak Tree Farm Architectural and Landscape Design Guidelines* are implemented appropriately for the proposed Phase III of the Oak Tree Farm subdivision, the following mitigation measure is recommended:

4.3.1 Mitigation Measure: The applicant shall add a new section to the Architectural and Landscape Design Guidelines for Phases I and II that specifically applies to Phase III of Oak Tree Farm. The section shall include all applicable mitigation measures, conditions of approval, and a map showing the location of the 13 lots.

4.4 SIGNIFICANCE AFTER MITIGATION

Impacts related to Land Use and Planning will be less than significant.

CHAPTER 5: GEOLOGY, SOILS, AND GRADING, HYDROLOGY AND DRAINAGE

Background

A number of geologic studies and analyses of the project site and vicinity have been conducted, and were used for the previous SEIR for PUD-89-17. These studies and analyses are:

Geotechnical Feasibility Evaluation on Oak Tree Farm Development (July 1986) and *Additional Subsurface Data on Oak Tree Farm Development* (December 1987) for the portion of Oak Tree Farm west of Foothill, prepared by Terrasearch, Inc.;
Geohydrologic Investigation on Oak Tree Farm Development (May 1987) prepared by Terrasearch, Inc.;
Geotechnical Investigation on Oak Tree Farm (November, 1990), prepared by Terrasearch, Inc.;
Description of Landslide Mitigation on Oak Tree Farm (July 1991), prepared by Terrasearch, Inc.;
General Plan of the City of Pleasanton;
Final Resource Analysis for Ridgelands Regional Park (June 1987) by the East Bay Regional Park District;
Oak Tree Farm Draft Environmental Impact Report, Alameda County Planning Department (July 1988); and
Draft Environmental Impact Reports for the Golden Eagle Farm development (October 1985, City of Pleasanton) and the Garms Ranch development (April 1990, WPM Planning Team, Inc.). (The former project is located north of Oak Tree Farm and Castlewood Country Club on Pleasanton Ridge, with similar geologic and soil conditions).

These reports are available for review by the public in the Alameda County Planning Department office and the City of Pleasanton Planning Department office, and are incorporated herein by reference.

In 1992, the Pleasanton City Council certified an SEIR and approved PUD-89-17. One of the requirements of the SEIR and the PUD conditions of approval called for further geotechnical studies prior to any City approvals of the project's tentative subdivision map. At the time of the tentative subdivision map review, the City determined that the hillside area of the site, for which 17 lots were proposed, had not been demonstrated to be stable to the satisfaction of the City Council or the City's reviewing geologist. Consequently, the 17 lots were eliminated from the tentative subdivision map. The remaining 38 lots, which are Phase I and Phase II of Oak Tree Farm, have recorded final subdivision maps and construction of single-family custom homes is occurring.

In 1996, the project applicant conducted further geotechnical studies for the 17[3] lots: *Geologic and Geotechnical Update for Analysis of Hillslope Lot Development Oak Tree Farm (Tract 6898)*, Terrasearch, Inc., November 19, 1996; and *Stability Analysis of Ancient Landslide Oak Tree Farm (Tract 6898)*, Kleinfelder Inc., November 25, 1996. The results of these studies have been reviewed by a peer reviewing geologist (Alan Kropp & Associates, Inc.) that was selected by the City. These studies and the review of the peer reviewing geologist have provided the information for this section regarding issues related to landslides on the project site.

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3 Note that the applicant has subsequently reduced the number of lots from 17 to 13.

The complete text of these studies and the review by Alan Kropp & Associates are included in Appendix C of this SEIR.

5.1 EXISTING SETTING

Geologic Setting

The following geologic setting information is excerpted from the 1996 Terrasearch, Inc. report and the December 9, 1996 letter from Alan Kropp & Associates, Inc.

Published regional mapping (Hall, 1958, and Dibblee, 1980a,b)) shows the eastern flank of the Pleasanton Ridge as marking the boundary between Cretaceous marine sediments under the Ridge and younger marine and non-marine sediments in the Livermore Basin. The contact is marked by the Calaveras Fault, a known active fault. The "Earthquake Fault Zone" [4] area, in which the State of California requires seismic investigations, is located about 1,000 feet southwest of the project site. In the site vicinity, the fault itself is concealed under a massive landslide complex that extends for many miles along the eastern flank of the Ridge. Herd (1978) and Nilsen (1973) show the landslides extending from one mile south of Oak Tree Farm to about 2.5 to 4 miles to the north. This landslide complex is a deep-seated ancient landslide called the Castlewood Landslide Complex, and it ranges between 2,000 to 4,000 feet wide and extends along the base of Pleasanton Ridge for about three miles.

The Castlewood Landslide Complex underlies nearly all of the 13 lots, with the exception of Lots 2, and 3, although the toe of the landslide complex encroaches slightly into the northwestern corner of Lot 3 (refer to Maps 5-1 and 5-2 for location of lots).

Since the depth to groundwater and shear strength along the slide plane of the landslide may be different in static (non-earthquake) conditions than in dynamic (earthquake) conditions, these two conditions are described separately below in the Impacts Analysis.

In addition to the Castlewood Landslide Complex, there are other more recent landslides that have also been described in the 1996 study prepared by Terrasearch, Inc.

Description of Castlewood Landslide Complex

The following description of the Castlewood Landslide Complex is excerpted from the 1996 Terrasearch, Inc. report.

The Castlewood Landslide Complex (referred to as a "deep and/or ancient landslide") underlies all of the hillside portions of Oak Tree Farm and extends upslope as far as the upper one-third of the east flank of Pleasanton Ridge between the 800-foot elevation and the 1,300-foot ridge top elevation. This steeper slope section may contain sections of the ancient landslide and appears to be of landslide scarp

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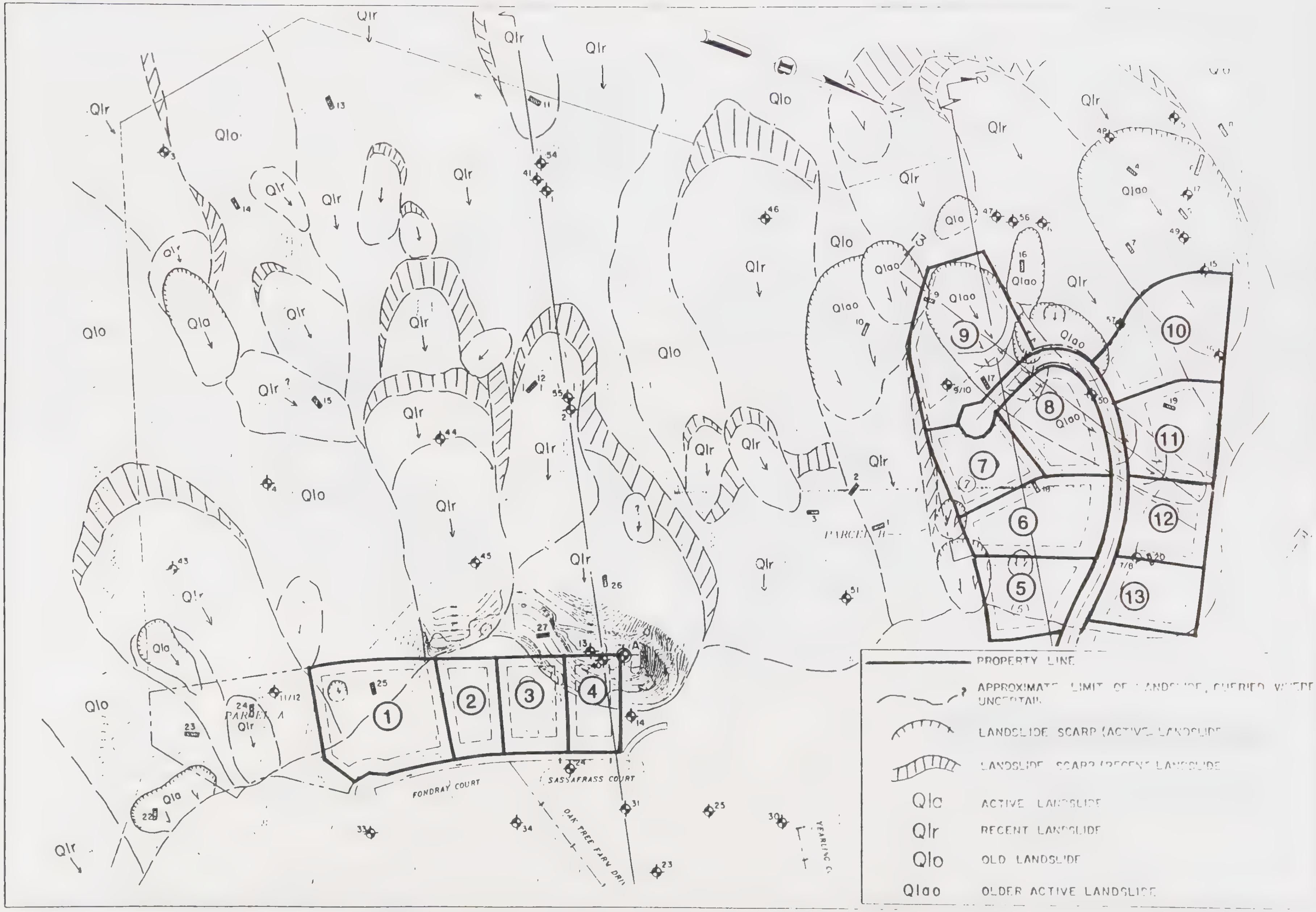
4 If an area is located within 1,000 feet of a known active fault, the State of California requires special seismic investigations.

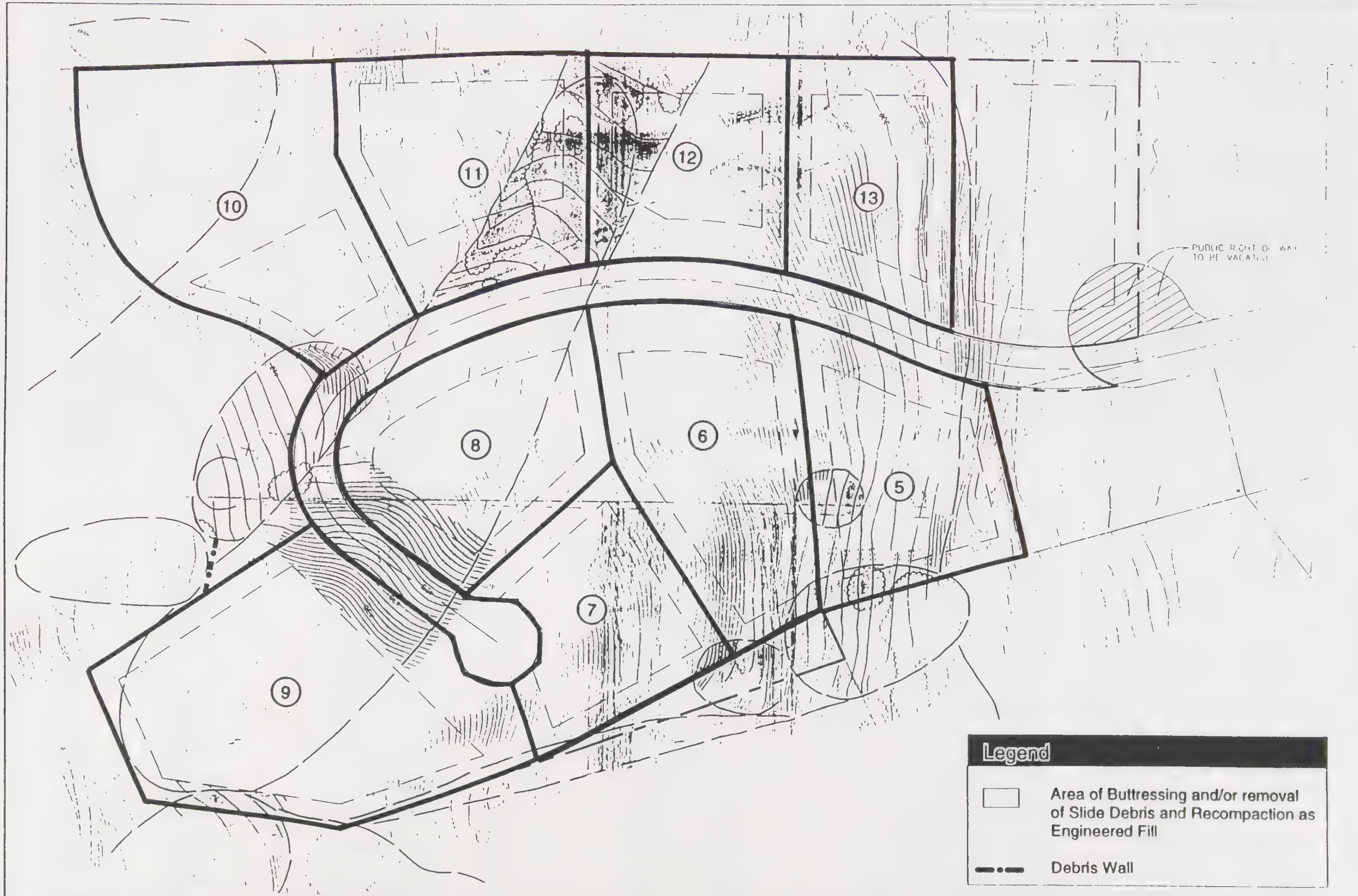
KatzHollis



GEOLOGICAL SITE PLAN
Oak Tree Farm
Phase III
PUD-97-01

Map 5-1
Not to Scale
Source: Terrasearch

KatzHollis



Proposed Areas of Buttressing and/or
Removal of Slide Debris- Lots 5 throught 13
Oak Tree Farm
Phase III
PUD-97-01

Map 5-2
Not to Scale
Source: Terrasearch

origin, although it also may be partially derived from fault scarp origins as well. The landslide was found to be 89 feet deep at the outer edge of the terrace at the base of this scarp. This area is still far upslope from Oak Tree Farm.

Within Oak Tree Farm, this ancient landslide is found at similar depths in the deeper exploratory borings. The relatively undisturbed sedimentary strata near the base of the landslide as well as some bedding exposures on the Oak Tree Farm hillslope suggest that large portions of the ancient landslide failed by a block glide mechanism.

The depth of the ancient landslide near its toe was found at 85 and 82.5 feet. This level is about 40 to 50 feet below the elevation of the valley floor. According to Keith Kelson (personal communication in 1996 with Terrasearch, Inc.), the rate of alluvium accumulation in the site vicinity is probably greater than 40 feet within the last 40,000 years. Near the area of the proposed lots, the ancient landslide was defined as 80 and 88 feet. Towards the south side of the landslide, the depth was defined as 106 feet. The depth in this area was somewhat ambiguous in both drive samples and cores owing to the relatively undisturbed nature of the sediments. However, an unambiguous marker was found at a depth of 74 feet, where the coring tube ran through a 10-inch redwood log section that was age-dated greater than 40,000 years.

The material in the basal shear zone of the ancient landslide appears to vary in different parts of the landslide. In the toe area, the shear plane was found to be a very dark gray seam of rubbery clay between one-fourth to two inches thick. In the upper part of the Oak Tree Farm property, it was a dark blue-green sheared silty clay. In the area of the proposed nine lots on the northern portion of the site, the base was observed at a layer of sandy gravel and/or gravelly sand. In the upslope end of the landslide (off-site), the basal zone was a very dark gray pebbly to gravelly clay.

Description of Shallower Landslides

The following description of the shallower landslides is excerpted from the 1996 Terrasearch, Inc. report.

In general, the most recently active landslides are probably the shallowest, with depths generally ranging from 30 to 40 feet. The base of these landslides in the upslope appear to be marked by a transition from light brown pebbly or gravelly silt to harder, darker colored gravel and sand. Farther downslope, the base of shallower landslides seems to be masked by lithologies of weathered bouldery gravels that occur close to the surface.

Drainage and Surface Water

The following description of drainage and surface water on the site is excerpted from the Draft Supplemental Environmental Impact Report for Oak Tree Farm PUD-89-17 (SCH#90030991), October, 1991.

The project site is located within the Alameda County Flood Control and Water Conservation District Zone 7 (ACFCWD) watershed. Mean annual precipitation over this watershed area ranges from 23 to

25 inches. The highest annual rainfall on the project site occurs between November and April, as a result of moisture-laden air flowing from the Pacific Ocean.

Stream flows in swales and gullies on-site reflect the seasonal distribution of rainfall. Winter flows are higher and increase during and immediately following storms. Base flows generally decrease following the rainy season until the groundwater table drops below stream channel elevations. Hence, streams on the site are intermittent and usually dry during the summer months. During periods of normal rainfall, surface water flow does occur in the bottoms of gullies in the southern half of the site.

The hillside portion of the site has three steep, essentially natural ravine systems that drain this property, as well as over 100 acres of the EBRPD property upslope. Flows through these channels are generally restricted to storm water runoff during and shortly after storms. In some areas of the hillside, drainageways appear to have been disrupted or displaced by mass soil movement in the past.

At the foot of the hillside, the site drainage converges in open ditches that cross the pastures, go under Foothill Road in culverts, and discharge into two swales that carry the water to the Arroyo de Laguna. One swale is just north of Verona Road and the other is further south, crossing the City of San Francisco Water District property on the east side of Foothill Road.

The proposed project would rely largely on the natural ravine system, in combination with a series of interceptor ditches and culverts, to handle storm runoff on the hillside portion of the site. A portion of the northern ravine drainage is collected by three under-street culverts and directed towards the existing run-off channel along the northern property line. Other portions of the northern ravine drainage are collected by interceptor ditches which traverse Lots 6 and 7 and are channeled towards the interior of the site. Here, the storm water is recollected and channeled through a storm drain line proposed across Lot 4, which will connect with the storm drain line in the northern portion of the loop road.

The center ravine hillside drainage will be diverted into interceptor ditches just beyond the rear property lines of Lots 3 and 4. The run-off collected will be transferred via interceptor ditches and a storm drain line into the line in the loop road.

The southern ravine drainage would be collected into an inlet between Lots 9 and 10, and channeled into a proposed 18-inch pipe to connect with the proposed line on the southern portion of the loop road.

Groundwater Conditions

The following information on groundwater conditions is from the 1996 Terrasearch Inc. report.

A permanent groundwater table on the hillslope portions of Oak Tree Farm has been found only at great depths. This is a marked contrast from conditions in the Castlewood landslide immediately north of the site where groundwater tables are relatively high (approximately 20 to 30 feet below ground surface) and are coupled with a flatter overall slope angle. This may be partly due to less permeable soils in the Castlewood landslide as well as diversionary effects of an impermeable Calaveras Fault Zone.

Conditions of Approval for PUD-89-17

Mitigation measures related to geology, soils and grading, hydrology and drainage included in the Conditions of Approval for PUD-89-17 apply to this project as well. These measures include the following (note that the numbers below are the number of the condition in the Conditions of Approval for PUD-89-17):

"55. A detailed construction plan should be prepared by the project's geotechnical engineer and/or certified engineering geologist for the stabilization of all on-site landslides and potential landslides, all off-site slides that may affect the project or adjacent off-site developed areas. The depth and lateral dimensions of each landslide should include detailed sections and plans showing the limit of work along with detailed grading specifications for performance of the stabilization work. All landslides and potential landslides which could affect the proposed project should be stabilized by the developer before individual lots are sold.

56. Subsurface and surface drainage water should be controlled so that landslide instigation, initiation or reactivation will be minimized. All storm drainage should be in closed conduits. Concrete ditches with catch basins should be used frequently to catch surface water. A subdrain system should be installed to intercept subsurface water flow. Sediment basins should be installed to remove soils carried in storm water run-off.

57. The project geotechnical engineer and /or certified engineering geologist should provide detailed recommendations for the set back of structures from cut slopes, fill slopes, natural slopes and buttresses.

58. The project civil engineer should ensure that all recommendations of the geotechnical engineer and/or certified engineering geologist are reflected in the grading and drainage plans and implemented by the developer.

59. Lot grading should be performed as part of the overall subdivision grading recommended by the geotechnical and civil engineers...Modifications by builders or homeowners should not be permitted.

61. Due to the clayey nature of *in-situ* soils, grading should be performed during the dry months of the year to minimize potential compaction and erosion problems.

62. Areas possessing soil creep characteristics should be over-excavated and the soil replaced and compacted with engineered fill.

63. Filling of hillside lots along the northern property line should be kept to a minimum and not extend within 50 feet of the northern site boundary.

64. A final storm drain plan shall be provided to the City Engineer for his/her review and approval prior to the tentative map approval.

65. An on- and off-site hydrology and hydraulics study should be performed by a qualified civil engineer. Use standard engineering techniques to resolve deficiency of existing storm drain system, if any.

66. The developer's engineering staff and consultants should prepare recommendations and plans for preventing erosion and scour of natural creeks and existing drainageways. The method of creek protection should be chosen in consultation with the Alameda Flood Control District. Plans and recommendations should be provided for construction of concrete "v" ditches on all cut and fill slopes within the subdivision. The City should determine who should own and maintain the project site's creeks and drainageways. They should not be owned or maintained by any individual homeowner.

67. The approved erosion control plans and recommendations prepared by the developer's staff and consultants should be installed as shown on the approved drawings. The developer's engineers should provide continuous inspection during construction in order to ensure that the construction work is performed properly.

68. Planting and hydroseeding should be done to prevent surface (sheet) erosion. Effective erosion control provisions should be installed as detailed by the Association of Bay Area Governments. In addition, good construction practices should be followed during grading operations to control wind and water erosion of excavated and exposed surfaces.

69. All fill placed for subdivision roadways and infrastructure should be placed in such a manner so as to minimize differential settlement. The developer's geotechnical and civil engineers should provide detailed recommendations and plans for acceptable cut and fill slope gradients, stripping, preparation of the subgrade to receive fill (including keying, benching and construction of subsurface drains under fill placed on slopes), acceptable fill material, and fill placement requirements (including method of placement and degree of fill compaction). Existing fill on the site which was not properly placed or compacted should be removed and replaced with engineered fill. All fill placed on site should be engineered fill, that is, fill placed in accordance with the recommendations of a geotechnical engineer.

70. The grading for the subdivision roadways and infrastructure should be performed as recommended by the geotechnical and civil engineers. The developer's engineers should provide continuous inspection when subdivision grading operations are being performed in order to ensure the grading work is being performed properly.

71. All fill placed during individual lot grading should be placed in such a manner as to minimize differential settlement. A subsurface investigation by a geotechnical engineer should be performed on each lot before lot grading begins. The geotechnical engineer should provide detailed grading and foundation recommendations for each lot and house. The individual lot owner's geotechnical and civil engineer should provide detailed recommendations and plans for acceptable cut and fill slope gradients, stripping, preparation of the subgrade to receive fill (including keying, benching and construction of subsurface drains under fill placed on slopes), acceptable fill material, and fill placement requirements (including method of placement and degree of fill compaction). The geotechnical recommendations for each lot should be compatible with the overall geotechnical design for the entire subdivision.

72. The individual lot grading should be performed as recommended by the geotechnical and civil engineers. The lot owner's engineers should provide continuous inspection when lot grading is being performed to ensure the grading work is being performed properly.

73. A geotechnical investigation should be performed on each lot. The expansion potential of the native materials and fill on the lot should be evaluated by the geotechnical engineer. The geotechnical engineer should provide foundation design, soil preparation and grading recommendations which are appropriate for on-site soil and geologic conditions. The corrosively of the native soils and fill should also be evaluated by the geotechnical engineer. All steel pipe should be coated or have catholic protection.

74. The surface drainage system on each lot should be designed by a qualified civil engineer and should be compatible with the drainage system for the subdivision. The following items should be included in each lot's surface drainage system:

a. Surface drainage should be carefully controlled at the base of all slopes adjacent to building pads. The civil engineer should submit proposed drainage techniques to the City for approval; taking aesthetics as well as engineering criteria into account. Drainage improvements should be appropriate for the slope on the lot; concrete-lined V-ditches should be used only where equivalent and less obtrusive techniques are not appropriate for use.

b. All building pads should be rough graded with a 2 percent slope.

c. All roof downspouts should be connected to a solid pipe collector system which discharges at a suitable outlet.

d. The crawl space of each house should be provided with a drainage system which will discharge all water which might enter the crawl space.

e. The surface next to the house should be graded with a slope of at least 2 percent away from the house for a minimum distance of 4 feet. The lot should be drained with swales which slope 2 percent and discharge at a suitable outlet.

f. Landscaping and walks should be installed such that the lot drainage system designed by the civil engineer is not disrupted. Water should not be allowed to pond on the lot.

g. Conditions, covenants and restrictions (CC&Rs) for the subdivision should include the lot drainage requirements. Specific reference to drainage requirements should be included in the deed for each lot in order to prevent homeowners from altering drainage on the lot.

75. The recommendations and plans provided by the lot owner's geotechnical and civil engineers should be carried out completely and correctly by the owner's contractor. The geotechnical and civil

engineers should provide continuous inspection during construction in order to ensure that their recommendations and plans are being properly implemented.

76. Prior to tentative map approval, the potential for seismically induced landslides and liquefaction must be investigated in detail. Detailed investigations are required for evaluation and preparation of slope stabilization plans. This investigation must include an evaluation of the potential for activation of landslides during an earthquake. If a high potential for activation exists, then the slope stabilization plans must include measures for reducing the likelihood of earthquake caused landslides. In addition, the liquefaction potential of the soil must be evaluated. If a high liquefaction potential exists, then recommendations for minimizing future damage must be incorporated into the subdivision design.

77. All buildings should be designed and constructed in accordance with the City of Pleasanton building codes, particularly those sections of the codes regarding earthquake resistant design. The geotechnical investigation report for each lot should include earthquake design recommendations including recommendations for site period or soil profile coefficient as well as a discussion of seismically induced landslides.

78. The surface drainage system for the development as a whole should be evaluated by the geotechnical engineer and engineering geologist in order to determine the effects of the surface drainage system on springs and the groundwater regime at the site.

79. The recommendations of the geotechnical engineer and engineering geologist should be implemented by the developer's contractor during subdivision grading. All cut and fill slopes should be inspected by the engineering geologist during grading in order to locate and evaluate any new springs which may be found during grading operations. The location of all subsurface drains should be shown on as-built drawings.

80. The individual homeowners should avoid over-irrigating landscaped areas. Excessive irrigation water is a common cause of groundwater seepage problems. In addition, the recommendations of the geotechnical engineer and engineering geologist should be implemented by the lot owner's contractor during lot grading. All cut and fill slopes should be inspected by the engineering geologist during grading in order to locate and evaluate any new springs which may be found during grading operations. The location of all subsurface drains should be shown on as-built drawings."

5.2 IMPACT ANALYSIS

Criteria for Significance

According to applicable definitions in the CEQA Guidelines Appendix G, a project will normally have a significant effect on the environment if it will expose people or structures to major geologic hazards, cause substantial erosion, or flooding.

Static (Non-Earthquake) Conditions

The analyses contained in the 1996 Terrasearch and Kleinfelder reports were primarily focussed on the ancient landslide, although the Terrasearch analyses also included some description of recent landslides. The analyses reviewed the slope stability for various possible soil strength parameters and groundwater conditions to evaluate the stability of the ancient landslide, and its potential impact on the proposed development of the 13 lots. The slope stability analyses indicate that the ancient landslide possesses a minimum static factor of safety equal to 1.5, which is considered the acceptable minimum by the industry, assuming zero cohesion and a friction value ranging between 20 to 22 degrees along the potential slide plane for all possible groundwater conditions analyzed for this project. When an estimated cohesion value of 300 pounds per square foot (PF) is added to the soil strength, a minimum safety factor of 1.5 can be achieved with a friction angle value between 17.5 and 20 degrees. The analyses concluded that the ancient slide underlying the proposed project is stable under static conditions for the groundwater conditions that could be expected to occur at the site. The Alan Kropp & Associates evaluation of the reports by Terrasearch and Kleinfelder concurred with this conclusion. **Therefore, impacts related to the stability of the ancient landslide under static conditions are less than significant, and no mitigation measures are required or recommended.**

Dynamic (Earthquake) Conditions

Kleinfelder, Inc. conducted pseudo-static slope stability analyses to evaluate the stability of the ancient landslide under seismic conditions. Based on the results of these analyses, the landslide will remain stable (i.e., a factor of safety greater than one) under seismic shaking associated with a lower level seismic event for the ranges of soil strength properties estimated and with all estimated possible groundwater conditions. The non-linear deformation analysis indicated negligible deformation during a lower level seismic event. However, during an upper level seismic event, the ancient landslide may experience some movements. That is, the absolute ground surface deformations were estimated to be between four and 11 inches at the upper portion of the slope and between one-half to one inch near the base of the slope using the most conservative groundwater condition. The estimated differential displacement within the extent of one structure is within two inches, and is not indicative of major damage. According to the analysis prepared by Alan Kropp & Associates, the most severe differential movements would take place on Lot 9, and a house located at the toe of the slope on Lot 5 would have differential movements of approximately one-half of those on Lot 9. **In the absence of mitigation measures, impacts to the proposed improvements related to the ancient landslide during an upper level seismic event are potentially significant.**

Drainage and Surface Water

Homesites would contribute substantial runoff to the drainage system from roofs, patios, driveways and other impervious surfaces. Hydrologic data developed by Greiner Engineering, Inc. (1987) indicate that the proposed project will increase storm water runoff from the project area by an average of 30 to 48 percent for a typical rainfall year. In some sub-basins, runoff from a 15-year storm will be increased by as much as 50 to 83 percent. The three major hillside ravines could have flows up to 70 cubic feet per second with velocities in the 10 feet per second range and flow of approximately a 2-foot depth. **This is considered a potentially significant adverse impact.**

The proposed storm drain system relies heavily on the use of natural drainage and interceptor ditches to collect run-off from the undeveloped hillside portion of the site. Natural drainage, in conjunction with culverts, is proposed across the hillside lots at the northern portion of the property. Storm water will be channeled across lots and potentially across building pad areas. Free-flowing storm water run-off could contribute to soil creep, slope or building foundation failure. **This is considered a potentially significant adverse impact.**

Recent, Older Active, and Active Landslides

The 1996 analysis prepared by Terrasearch, Inc. indicated that the more shallow landslides on the project site can be subdivided into three categories which are: recent, older active, and active landslides. In general, the report suggests that the impacts of active and older active landslides are potentially significant, and recommends mitigation measures, while the impacts of recent landslides are considered less than significant.

The evaluation prepared by Alan Kropp & Associates indicates that the remedial work for both active and older active landslides should be similar. The evaluation also states that many of the areas of landslides called recent in the Terrasearch analysis that affect the proposed lots may also have a very high potential for activity, particularly for the landslide deposits located directly south of Lots 5, 6, 7, and 9 (see Map 5-2). The upper portion of this landslide is indicated to be an older active landslide, but the lower portion is identified as a recent landslide. In addition, shear places were encountered in several test pits in other areas labeled as recent landslide deposits which are in the vicinity of hillside lots. This indicates that many of the landslides termed recent may also have significant potential for future activity, and may justify the need for remedial work. The Alan Kropp & Associates report also indicates that the landslide deposit that covers most of Lots 5, 6, 7, 12, and 13 should be analyzed further to determine the potential for future movement and whether additional remedial work is necessary.

Lots 10 through 13 extend along the northerly property line. These lots would average a 30 foot grade change between the proposed street and the rear property lines, which results in an average ground slope of 5:1. The existing ground elevation 100 feet from the northern property line is approximately 12 feet above the existing adjacent residences to the north. These lots are located on the "old" landslide and no landslide repair is proposed. Houses would need to have stepped finished floors to the rear to account for the grade change.

Lot 9 is proposed as a large custom home lot with no grading. The final lot owner would be allowed minimal grading to construct a house. The existing 30 percent ground slope and the large oak tree near the center of the proposed lot would require multi-level construction.

In the absence of mitigation measures, impacts related to the recent, older active, and active shallow landslides are significant.

5.3 MITIGATION MEASURES

Refer to Mitigation Measure 4.3.1 in the Land Use and Planning Chapter.

The following mitigation measures are from the 1996 Terrasearch, Inc. analysis and the reviewing document prepared by Alan Kropp & Associates, Inc.

5.3.1 Mitigation Measure: Any structures and improvements constructed on the slope of any landslide shall have flexible utility connections to accommodate ground movement during an earthquake.

5.3.2 Mitigation Measure: In terms of the ancient landslide, during a major earthquake, deformation of the landslide materials may occur. To accommodate this potential deformation, the foundations for all structures on Lots 1 through 13 shall be designed and reinforced to withstand a landslide deformation during a major earthquake, and this requirement shall be included in the Architectural and Landscape Design Guidelines. In addition, the street pavement and utility lines shall be designed to take into account a total differential movement of nine inches over 800 feet, which translates into a compressive strain of 0.1 percent.

5.3.3 Mitigation Measure: The remedial work for both active, older active, and recent landslides shall be similar, because the older active landslides have nearly the same potential for future movements as the active landslides, and because many of the so-called recent landslides may also have significant potential for future activity.

5.3.4 Mitigation Measure: The currently proposed buttress for Lots 1 through 4 may not be of sufficient size to restrain the very large landslide complex which extends upslope and beyond the limits of the project site. The current layout of the lots as shown on Map 5-1 do not appear to have adequate mitigation by the conceptual buttress shown on the map. Prior to approval of the tentative subdivision map, additional site-specific design work shall be performed to the satisfaction of the City to address this issue.

5.3.5 Mitigation Measure: For Lots 7 and 9, 30-foot setbacks will be required at the southern limit of the building areas on these lots. This condition will be recorded against each property in a form to be approved by the City, and the setbacks indicated in the lot-specific design guidelines to ensure that future homeowners are advised against new construction in this setback zone.

5.3.6 Mitigation Measure: The current remedial work scheme allows the homes on Lots 8 and 9 to be constructed on unrepaired (although partially buttressed) active landslide deposits. The proposed remedial grading shall be extended to repair this entire landslide complex within the proposed development area due to the potential for some future movement of the materials within the building envelopes. It may also be necessary to construct a buttress around the entire upslope perimeter of Lot 9 to protect the home from sliding from upslope, rather than just the partial buttress currently shown near the southeastern upslope limit of this property. Prior to approval of the tentative subdivision map, additional site-specific design work shall be performed to the satisfaction of the City to address this issue. Any proposed mitigations shall be subject to the review and approval of the City Engineer and shall be incorporated into the tract improvement plans.

5.3.7 Mitigation Measure: The older active landslide present in the northwestern corner of the property extends across Lots 10 and 11 and the entire deposit should be defined as active. The lower extension of this landslide shown on Map 5-1 should be designated as an older active (or active) deposit, and also should be included on Map 5-2. This portion of the landslide extends through the proposed building envelope on Lot 11. Prior to approval of the tentative subdivision map, further study shall be conducted by the developer regarding the possibility of and impacts of significant future movement in the northern portions of Lots 10 and 11, as well as the likelihood that this landslide complex will continue moving and damage the barn and home located immediately north of these lots on the adjacent property. If further study determines that this landslide could have significant future movement, and/or the landslide complex will continue moving and damage the barn and home, specific design measures will be provided that will address these instability problems, subject to the approval of the City. Said mitigations shall be incorporated in the development plans and tract improvement plans for the subdivision.

5.3.8 Mitigation Measure: Various portions of the recent landslide deposit which extends through Lots 10 and 11 have reactivated, including the two recent areas of failure immediately southwest of Lot 10. Prior to approval of the tentative subdivision map, additional analysis shall be performed to provide an assessment of the suitability of developing homes on Lots 10 and 11 under existing conditions. If such development is unsuitable, specific design measures will be provided prior to approval of the tentative subdivision map that will address these instability problems, subject to the approval of the City.

5.3.9 Mitigation Measure: The large area labeled older landslide within the northern hillside lots may also have future potential for movement based on the shear zones encountered in the test pits in this area. Because of the weak and sensitive character of this material, at a minimum, a large buttress shall be constructed to protect the roadway as it traverses this area due to destabilization the roadway grading might otherwise cause. Prior to approval of the tentative subdivision map, further studies of the activity level of this material within the proposed building areas shall also be performed to determine if additional remedial work is needed to stabilize the shallow 10-foot deep slide plane identified in the test pits in this area. If necessary, specific design measures that will address these issues as determined by the City Engineer will be developed prior to approval of the tentative subdivision map.

5.3.10 Mitigation Measure: Grading within the hillside lots which will be limited to no more than three feet of cut or fill. This shall be disclosed to potential buyers of each lot within the development and this restriction shall be included in the design guidelines. This disclosure statement shall be subject to the review and approval of the City Attorney and shall be presented for review prior to approval of the final subdivision map.

5.3.11 Mitigation Measure: All water collected within the building pads (including on structure roofs and paved surfaces) shall be transported to an approved storm drain system. No collected water shall be allowed to discharge onto project slopes. To accomplish this mitigation measure, an additional storm drain line extending near the northern property boundary or other mitigation acceptable to the City Engineer to properly discharge waters which are collected on Lots 10 through 13 may be necessary. The additional storm drain line shall be shown on the tract improvement plans.

5.3.12 Mitigation Measure: The project applicant shall perform detailed monitoring of the groundwater levels within the hillside area during the winter months, in order to determine whether there are any stability problems. The first such monitoring shall be completed by the developer and approved by the City prior to any grading in the hillside area. If it is determined that groundwater is a potential problem, the developer shall propose mitigations subject to the review and approval of the City Engineer. These mitigations shall be incorporated into the development plan and tract improvement plans for the subdivision. Monitoring of groundwater levels within the hillside area during the winter months shall be incorporated into the Geologic Hazards Abatement District monitoring program.

5.4 SIGNIFICANCE AFTER MITIGATION

Impacts related to geologic hazards, landslides, and slope instability will be less than significant.

CHAPTER 6: VISUAL IMPACT

Background

The City of Pleasanton has adopted various policies and ordinances regarding the scenic values of the community, particularly the foothills of the Pleasanton Ridge where the proposed project is located. The West Foothill Road Corridor Overlay District (WFRCOD) ordinance, to which this project is subject, has standards which attempt to reduce the visual impact of residential developments on the west side of Foothill Road.

Oak Tree Farm has unique visual significance due to its location on the west side of Foothill Road. In addition, the farm, with its barns, tree-lined drive and horses, had served as a visual landmark along Foothill Road. The remaining white wood fences, gated entry and tree-lined drive still serve as a landmark along Foothill Road.

There is overlap among visual concerns and other environmental issues, such as vegetation, land use and geology. If there is a discrepancy between information in this chapter, and that in the other chapters, the recommendations in those issue-specific chapters shall take precedence.

6.1. EXISTING SETTING

Visual Context of the Site

The rugged, wooded upper slopes of the Pleasanton Ridge rises above the site to the west. To the east is an arroyo, which is bordered in part by homes, while other sections remain undeveloped. To the north are residential estates, and to the south is the Ridgelands Regional Park, which has been left essentially in its natural state.

Foothill Road and Interstate 680 are designated scenic routes in the Alameda County General Plan, while Interstate 680 has been designated a scenic highway by Pleasanton's Scenic Highway Plan (1985).

Existing Site Features

The west part of the site is located on the lower slopes of Pleasanton Ridge. The eastern portion of the site consists primarily of land with an approximately 5 percent slope. Key visual features include:

1. Property elevations extend to 615 feet. The Pleasanton General Plan notes the special visual significance of terrain on the Ridge above this elevation.

2. Alteration of the site has occurred following the approval of PUD-89-17, which allowed for the subdivision of part of the eastern portion of the site into 37 lots for the construction of 37 single-family custom homes. There is also an existing residence on the site, (Lot A, the Currin residence) which was there prior to the subdivision.

3. Upper slopes of the site are covered with woodland and scrub vegetation, and several natural drainage swales, with heavy vegetation, which adds to the scenic value of the site.

Existing Policies and Guidelines Relevant to Visual Resources

1. Pleasanton General Plan

Conservation and Open Space Goals of the Pleasanton General Plan call for preserving all areas of outstanding scenic qualities. The Plan includes several policies and programs which emphasize protection of visual resources and sensitive site planning. These include:

- Preserve heritage trees by following the provisions of the Heritage Tree Ordinance when considering future development projects (p. VII-11).

- Preserve stream beds and channels in their natural state, except where needed for flood and erosion control. Design projects adjacent to the arroyos to protect habitat areas (p. VII-11).

- Protect all large, continuous areas of open space, as designated on the General Plan Map, from intrusion by urban development (p. VII-11).

- Preserve as permanent open space all areas of outstanding scenic qualities...(p. VII-12)

- Implement the recommendations contained in the Scenic Highway Plan for I-680 (p. VII-12).

- Prohibit construction in landslide areas and on terrain with slopes greater than 25 percent unless suitable mitigation measures are included in the site plans (p. VII-16).

2. West Foothill Road Corridor Overlay District (WFRCOD)

In July of 1990, the City of Pleasanton adopted an ordinance to aid the implementation of General Plan policies for the visual preservation of properties along Foothill Road. The corridor is designated an "area of special concern" in the General Plan Land Use element. The WFRCOD sets the following guidelines to limit visual impact:

"- Prohibition on fore-ridge development. No building sites within lots are permitted if they are on, or located near, ridges which do not have a background of Pleasanton or Main Ridges when viewed from Foothill Road.

- Mature native trees within the district shall be retained to the maximum extent feasible. Where feasible, mature oak and other native species should be relocated to grassland areas planned for development in order to soften the effect of new development within the corridor. New development landscaping shall be predominantly native plant species in areas visible from Foothill Road...

- Retaining walls visible from Foothill Road should be faced with materials compatible with the natural setting, such as stone or wood. Where feasible, retaining walls should be stepped. Landscaping shall be incorporated to minimize adverse visual impacts...

- Structures should be designed to be compatible with the rural, open setting comprised of oak woodland and grassland habitats. House design should reflect its setting not only in respect to its vegetative setting but also to its topographical setting. In particular, hillside lots should be built upon in a manner which reflects the sloping terrain, integrating the house into sloped areas.

- Street lighting shall be designed to minimize light and glare as seen from Foothill Road and the Valley floor. A preferred lighting design would utilize low poles with cut-off fixtures and walkway type lights. Street landscaping should be incorporated so as to screen lighting."

3. <u>Heritage Tree Ordinance</u>

Chapters 10 and 17.16 of the Pleasanton Municipal Code include controls on removing heritage trees growing within the City limits. Many of the trees on-site would be considered heritage trees (please refer to Chapter 8 for a detailed definition and identification of heritage trees). The Ordinance notes that preservation of these trees enhances the natural scenic beauty, improves property values, moderates climate, improves air quality, prevents soil erosion and helps to create an identity and quality which enhances the attractiveness of the City. The Ordinance allows for removal of heritage trees under certain circumstances, particularly where their preservation would preclude feasible development.

4. <u>Scenic Highway Plan for Interstate 680</u>

Interstate 680 has been designated a State Scenic Highway and is addressed also by the City's Scenic Highway Plan. This Scenic Highway Plan presents specific policies to supplement the Pleasanton General Plan, noting that views of the hillsides which surround Amador Valley contribute to the designation of this route as a scenic highway. The following goals and objectives are included in the Scenic Highway Plan:

"- In areas within the view-shed beyond the immediate highway corridor, scenic qualities should be preserved, retaining the general character of the natural slopes, water courses, vegetation and open space.

- As a means of preserving natural ridge skylines, no major ridgelines should be altered so that an artificial ridgeline results.

- Preserve existing large stands of vegetation along the highway.

- Preserve and encourage continued views to the surrounding hills.

- Preserve open space vistas along I-680."

Proposed Development Plan Features

The project applicant has developed Architectural and Landscape Design Guidelines for the project site, which have been approved in connection with PUD-89-17, but that also apply to the subject project. The Guidelines have a number of features and conditions of approval which affect visual quality. These Guidelines are in place for use by individual property owners and by the City's Design Review bodies. The Guidelines divide the site into six zones according to topography, City ordinances applicable to that area, relation to neighboring properties, and the Conditions of Approval for PUD-89-17. Each zone has different requirements and restrictions for development in that zone in terms of height limits, set backs, floor area ratios, etc. The 13 lots that comprise the subject project are in zones 3, 5, and 6 (see Map 6-1).

To protect trees, natural open space and limit the visual effects of grading, the applicant will be required to designate specific buildable areas for each lot. Construction outside of these areas will be prohibited.

Conditions of Approval for PUD-89-17

Mitigation measures related to visual impacts of structures included in the Conditions of Approval for PUD-89-17 apply to this project as well (note that the numbers below are the number of the condition in the Conditions of Approval for PUD-89-17). These measures include:

"15.a. The project landscape design guidelines shall include specific requirements for landscape installation for Lots 6 through 9. Landscaping for these homes shall be located on the lot to screen those portions which are most visible from Interstate 680. In particular, the use of a combination of large-sized, fast-growing native species as well as smaller-sized, additional oak trees (native to the site) shall be required for these sites. Native plant materials will provide less visual contrast with the existing hillside vegetation and further reduce visual impact.

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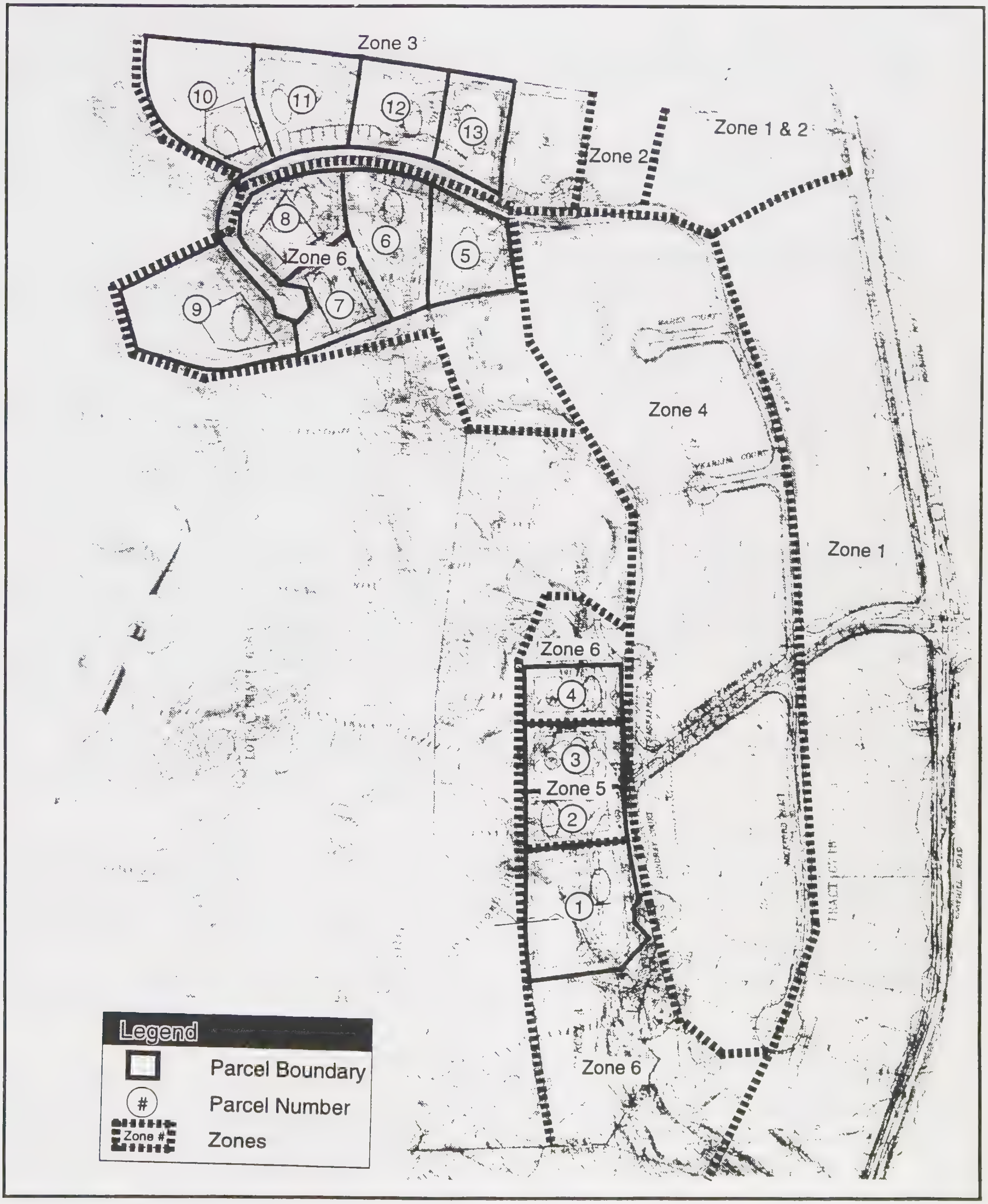

ARCHITECTURAL AND LANDSCAPE DESIGN GUIDELINES ZONES
Oak Tree Farm
Phase III
PUD-97-01

Map 6-1
Not to Scale
Source: Dommer & Byars

Ornamental plant and turf installation shall be limited as much as possible on these lots. shall be located in areas away from freeway visibility and shall be screened with native vegetation to reduce visual contrast.

15.b. Homes shall be located on these lots to take advantage of as much of the native vegetation as possible. The architectural design guidelines shall identify clearly the preferred structure location for these lots.

15.c. Homes on these lots shall be of a stepped house design to better adhere to the natural contours of the hillside. These homes shall be limited to 30 feet in height (measured from lowest point of grade to roof ridge) to minimize the visual conspicuousness of the homes.

16.a. All homes along the northern property line (Lots 10-13) shall be limited to one-story in height, measured from lowest finished grade to highest roof pitch. This limitation shall include both portions of split-pad lots.

16.b. All homes along the northern property line shall maintain a "low profile" silhouette, with roofs not exceeding a 6:12 pitch.

16.c. The Landscape Guidelines shall include specific requirements for landscape installation along the northern (rear) property line of Lot 13. Vegetation shall mature quickly enough to screen the rear yards, yet shall not be so dense as to preclude all views of the hillside from the rear yards of the Country Lane homes. The project Landscape Architect shall recommend the plant materials best suited to this purpose, and these shall be included in the Landscape Guidelines, subject to the review and approval of City staff.

16.d. The project Architectural Design Guidelines shall indicate building envelope areas which locate homes towards the front of the lot, limiting construction of all structures and recreation amenities (pools, spas, gazebos, etc.) in the rear yard areas.

16.e. Building pads for homes along the northern property line shall be limited in the amount of fill, to ensure that the natural grade is maintained as much as possible, and that the homes do not "gain" height and impede the views, or impact the privacy of adjacent residents. The amount of fill for building pads shall not exceed three feet.

Mitigation measures related to tree loss impacts included in the Conditions of Approval for PUD-89-17 apply to this project as well. These measures include:

17.a. Protect roots of heritage trees through measures suggested in the Heritage Tree Ordinance and the project landscape guidelines. A qualified arborist should be present during road grading activities to suggest and perform measures necessary to preserve trees. Trees which are to be preserved shall have fences constructed around the entire tree at the dripline prior to grading and construction activities and shall be maintained through the duration of grading and construction activities.

17.b. No more than three additional heritage trees may be removed due to roadway grading and construction, building pad grading and other site preparation activities, not including landslide repair measures.

17.c. Lot 10: Removed trees shall be replaced at a six to one ratio with local native species, in a variety of sizes ranging from 15-gallon to 36-inch box. These trees shall be located along the westerly and northerly property lines to help screen the proposed house, provide privacy for the adjacent neighbor and to re-establish the biotic balance of the tree stand. These trees shall be installed prior to completion of the home.

17.d. All trees, but especially the heritage and smaller oak trees[5], shall be preserved to the greatest extent possible. Tree preservation measures shall be outlined in a Tree Preservation Plan, to be prepared by a qualified arborist, and approved by City staff. Where removal of trees for construction or grading for home sites is unavoidable, trees shall be replaced at a six-to-one ratio, with the replacement trees to be a combination of native 15-gallon, 36-inch and 48-inch box trees. These trees shall be located so as to screen the proposed homes from view, and to re-establish any biotic relationships with the existing stands of trees from where trees were removed.

17.e. In all cases where a heritage tree is incorporated within the lot and street landscaping of the development, or a heritage tree occurs immediately adjacent to a site designated for grading, no grading or vehicle soil compaction shall occur within four feet of the outer leaf circumference of the tree. Trees which are to be preserved shall have fences constructed around the entire tree at the dripline prior to grading and construction activities and shall be maintained through the duration of grading and construction activities. This zone shall be identified plainly by a series of four-foot high stakes flagged with orange tape and placed at six-foot intervals around this zone. In addition, no high use human activities shall be placed under large heritage oaks (this restriction also shall be incorporated into the project landscape guidelines and homeowners' CC&Rs).

No root pruning within the dripline or crown pruning of any heritage trees to be affected by grading, landslide repair or building pad preparation shall occur.

17.f. All lots which have a downhill segment adjacent to heritage tree sites shall have a cement curb-type drain installed along the length of its border. Summer surface run-off water from lawn and yard watering shall be shunted by the curb drain to a storm water system and away from the root zone of the oaks. In addition, drought-resistant native landscaping shrubs and trees shall be used for the homesites, rather than water-demanding exotic species."

Mitigation measures related to fencing impacts included in the Conditions of Approval for PUD-89-17 apply to this project as well. These measures include:

"84.f.i. Privacy fencing shall be of welded wire mesh screened with landscaping and shall not exceed 72 inches in height. Masonry block, slumpstone, etc. walls are not permitted.

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[5] NOTE: Retaining all of the larger and older heritage oak trees on the site at the expense of younger, non-heritage trees could result in long term impacts to the entire oak tree population on the project site. Over a time period of 50 to 100 years, differential preservation of heritage trees is likely to lead to a reduction in the overall numbers, health and vigor of the oak tree population. If smaller, younger trees are always selected for removal, the population would be comprised mostly of older, mature trees and consequently, there would be an inadequate reserve of young trees to replace the trees that die or become diseased.

84.f.iii. Fencing for pools and tennis courts shall be of welded wire mesh, but must be screened by landscaping. Such fencing for pools must meet UBC requirements, but shall not exceed 72 inches in height.

84.f.iv. Fencing for tennis courts shall not exceed 12 feet. Opaque dark green panels may be installed in the interior side of such fences.

Mitigation measures related to lighting impacts included in the Conditions of Approval for PUD-89-17 apply to this project as well. These measures include:

84.g.i. A final site lighting plan shall be reviewed and approved by the Design Review Board prior to approval of the final map.

84.g.ii. The lighting plan should include "candlestick" type lights along the project streets, low poles with cut-off fixtures, and walkway type lights. All lighting shall be screened from Foothill Road.

84.g.iii. Tennis court lighting shall be directed downwards, and away from Foothill Road and adjacent residences. Said lights shall not exceed 15 feet in height. Mercury lights shall be prohibited.

84.g.iv. The developer shall submit a detail of the proposed street lighting for the project. The design of the street lights shall be approved by the City Engineer. If a lighting fixture is chosen that is not a PG&E standard, the homeowners shall pay the difference between the operating and maintenance charges between the selected light and the City standard light."

6.2 IMPACT ANALYSIS

Criteria for Significance

In evaluating the visual impacts of the project, the policies and ordinances adopted by the City of Pleasanton will serve as a guide to the predominant aesthetic preferences of area residents and the community. These policies limit the removal of trees and amount of grading, and emphasize the protection of natural features and views. The City emphasizes sensitive development in the hillside areas, particularly in relation to an existing neighbor's privacy and promotes a rural character of residential development along Foothill Road. For the purposes of this SEIR, alterations of the natural environment, interruption of views, and development which is intrusive or incongruous in appearance are considered significant adverse impacts.

A distinction is made between short-term and long-term visual impacts. For example, a hillside undergoing landslide repair, or any sort of grading, would be considered short-term impacts since, when properly reseeded and contoured, its appearance may change to a more natural one within one or two years. Structures directly adjacent to a road, however, may have continuing visual impact over the years. In general, adverse visual impacts decrease over time as viewers adjust to the environmental change. For this analysis, a long-term visual impact is considered one that lasts more than three years without decreasing to a less-than-significant level.

Short-Term Impacts

Grading. Grading for building pads will introduce changes in topographic form and vegetation patterns in the landscape setting. The road that accesses Lots 5 through 13 is also of concern since it is perpendicular to many viewers' line of sight and it climbs in elevation. The homesites around the knoll at the end or this road will be very visible. **Grading for the 13 lots will result in a significant short-term visual impact.**

Landslide Repairs. Extensive grading, re-contouring of the hillside and some removal of mature vegetation will occur for necessary landslide repairs. These landslide repair measures will create a short-term visual impact during the repairs. Until the re-vegetation grows over the landslide repair scars, there will be significant visual contrast between the natural hillside covered with mature vegetation and the slide repair areas. **Grading due to landslide repair is considered a significant short-term impact.**

Structures. The visual contrast of the new structures with the landscape will be high in the short-term. As landscaping around the structures matures, the structures will become less noticeable. **This is considered an adverse, but less than significant, short-term impact.**

Long-Term Impacts

Change in Open Space Character. The principal long-term visual impact is the loss of scenic open space in the project area. This project is part of the continued expansion of residential uses south into what has been a relatively undisturbed rural and natural setting. The landscape character of the site would change from that of a rural, hillside, open space character to a low-density residential character. A total of 13 new homes would be constructed. Since the majority of the lots are on the northern border of the Oak Tree Farm property, they will be most noticeable for residents living adjacent to and with a view of the site (i.e., those on Country Lane), and for motorists travelling along Foothill Road and Interstate 680. There is however, an established pattern of large-lot single-family residential development along Foothill Road. The proposed landscaping for the project will, in the long-term help to reduce the visual impact of the new homes. **Even with the above measures 15 a through c and 16a through e that are part of the project, the loss of scenic open space is considered a significant impact.**

Tree Removal. The City has a Heritage Tree Ordinance that provides controls on removing specimen trees within the City. There are a number of heritage trees on the project site. Map 8-1 in Chapter 8 provides the general location of these trees. Some trees may be removed for site development and landslide repairs. Even if not removed, trees can also be damaged during grading and construction, or due to improper care once the project is completed. The Architectural and Landscape Design Guidelines include instructions for homeowners to ensure the preservation of heritage trees. The Heritage Tree Ordinance prescribes ways to preserve trees during grading and construction, and imposes fines for unauthorized removal of trees. **Even with these measures that are part of the project, the loss of heritage trees is considered a potentially significant impact.**

Project Landscaping. Introduced landscaping for the homesites can produce a visual impact in terms of the contrast between the homesites and the hillside scattered oak woodland and grassland. Mitigation measures related to tree loss impacts included in the Conditions of Approval for PUD-89-17 apply to this project as well. Refer to measures 17.a. through 17.f. above. **With implementation of these measures, impacts related to project landscaping are considered less than significant.**

Fencing. Inappropriate fencing could diminish the visual quality of the site, particularly if solid fencing is built adjacent to the open space areas, or between lots on the visually prominent hillside lots.

With implementation of measures 84.f.i through 84.f.iv that are part of the project, impacts related to fencing are considered less than significant, and no additional mitigation measures are required or recommended.

Lighting. Night lighting on the site will increase with the addition of 13 more dwelling units. These changes would be apparent to residents adjacent to the site, as well as to others familiar with the site. Night lighting would increase ambient light levels in the immediate surroundings and might be visible from I-680.

With implementation of measures 84.g.i through 84.g.iv that are part of the project, impacts related to lighting are considered less than significant, and no additional mitigation measures are required or recommended.

6.3 MITIGATION MEASURES

6.3.1 Mitigation Measure: This mitigation measure is recommended to protect trees, natural open space and to limit the visual effects of grading: prior to approval of the tentative subdivision map for the 13 lots, the applicant shall be required to submit a map showing designated specific buildable areas for each lot. To the extent feasible, the buildable areas shall be sited to minimize heritage tree removal, preserve natural open space, and limit the visual effects of grading. The buildable areas shall also be sited to minimize views of the structures from off-site.

Refer to Mitigation Measure 4.3.1 in the Land Use and Planning Chapter.

6.4 SIGNIFICANCE AFTER MITIGATION

Visual impacts are considered significant and unavoidable.

CHAPTER 7: NOISE

An analysis of the effect of traffic noise on the project conducted by Charles M. Salter Associates, Inc. in October 1997 is summarized in this chapter.

This chapter also summarizes an analysis of the noise effect of the proposed project on its surroundings from a preliminary environmental noise assessment conducted by Illingworth and Rodkin, Inc., Acoustical Engineers for the SEIR for PUD-89-17.

7.1 EXISTING SETTING

The standard unit of measurement of sound is the decibel (dB). Since the human ear is not equally sensitive to sound at all frequencies, a special frequency-dependent scale has been devised to relate noise to human sensitivity. The A-weighted decibel scale [dB(A)] performs this compensation.

Community noise levels are commonly expressed in decibels on a scale which averages noise over a 24-hour period with a weighting or penalty factor for the greater impacts of noise intrusion at night. (The technique used averages the energy content of noise, not the level in decibels). One such noise measure in common use in California is the Day-Night Average Sound Level [DNL].

Existing Noise Sources

The major noise source affecting the project site is traffic on Interstate 680 (I-680), which is elevated approximately 50 - 75 feet above the lower portion of the site. Other noise sources include aircraft flyovers, local traffic and train passbys on the Union Pacific and Southern Pacific Railroads. The noise from I-680 is audible throughout the site, but is particularly evident on the hillside slopes, where the home sites are elevated enough to overlook the freeway. In addition, there are no intervening ridges to block freeway noise.

The analysis prepared evaluates the exterior noise levels at the project site and recommends mitigation measures to ensure that the City of Pleasanton General Plan noise levels of 60 dB L(dn) for residential rear yards is not exceeded. Noise effects also were evaluated against the City of Pleasanton General Plan requirement that noise sources not exceed 45 dB L(dn) for residential interiors.

Conditions of Approval for PUD-89-17

Mitigation measures related to noise impacts included in the Conditions of Approval for PUD-89-17 apply to this project as well. These measures include:

"49. The Oak Tree Farm Architectural Guidelines shall indicate that homes sited on noise-impacted lots (Lots 6 through 10) shall be designed to shield the rear yard areas from freeway noise, and that solid fencing may be permitted in very limited areas of the rear yard area of these lots (i.e., around pool and patio areas ONLY), but said solid fencing shall be screened with landscaping. Solid fencing shall consist of unpainted wood.

50. Mechanical ventilation should be provided for homes to allow windows to be closed to achieve indoor noise levels. Only windows facing the freeway would need to be closed to achieve the General Plan indoor noise goal of 45 dB L(dn).

51. Homes located on hillside sites, particularly Lots 6 through 10, shall make use of construction techniques to ensure that noise levels inside the home meet City of Pleasanton standards. Such lots should be identified in the project architectural design guidelines."

7.2 IMPACT ANALYSIS

Criteria for Significance

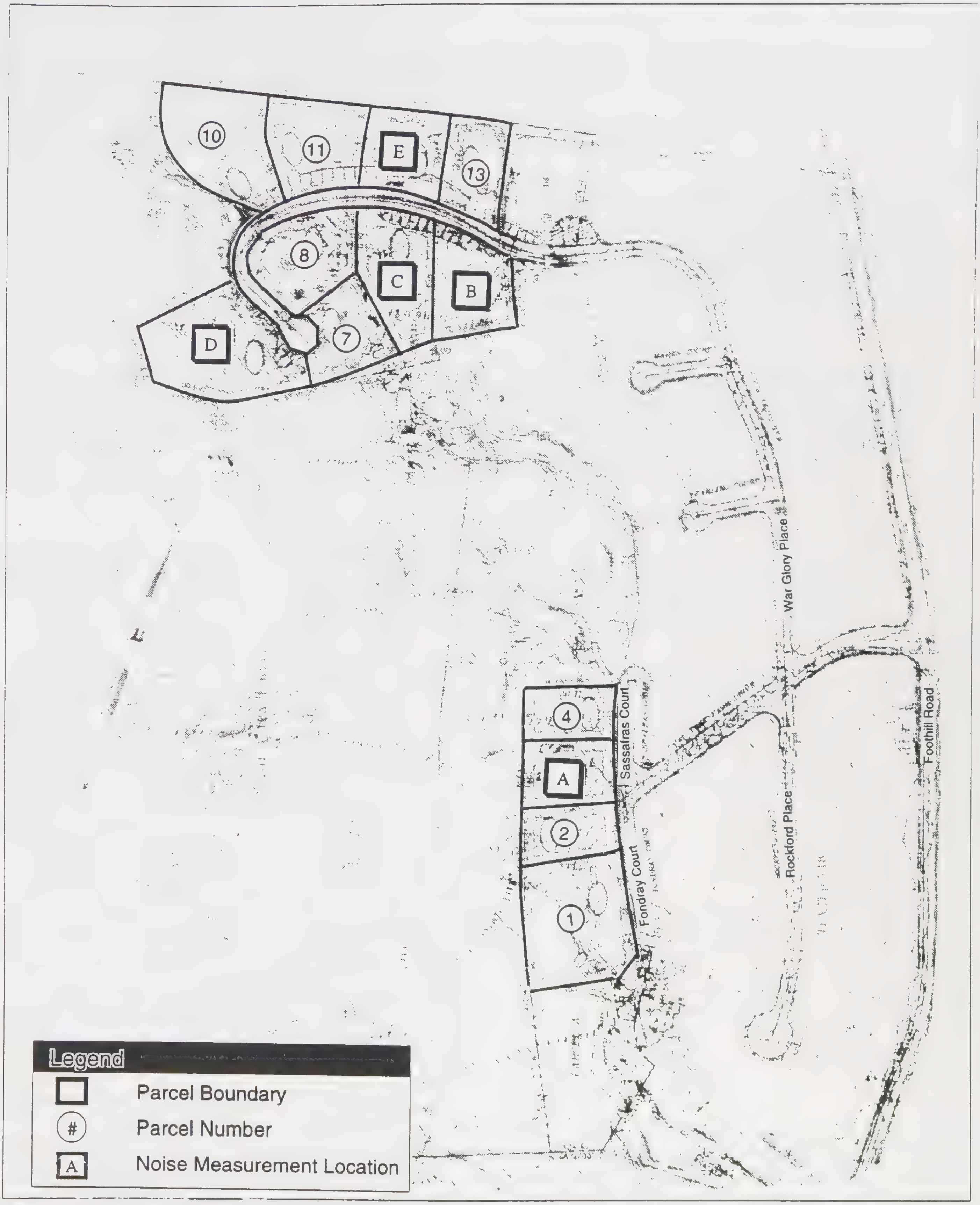
Applicable noise criteria for the project are contained in the City of Pleasanton's General Plan Noise Element. A Day/Night Average Sound Level (DNL) of 60 dB or less is considered "normally acceptable" for residential land use. A DNL of 60 to 75 dB is considered "conditionally acceptable". The City uses the DNL of 60 dB as a goal for outdoor noise levels in residential areas. However, the City recognizes that this goal cannot necessarily be reached in all residential areas within the realm of economic or aesthetic feasibility. This goal should generally be applied where outdoor use is a major consideration such as backyards of single-family residential developments. Front yards can generally tolerate a DNL of up to 65 dB according to the Noise Element.

The City of Pleasanton applies an indoor noise level criterion of DNL 45 dB to new single-family homes. Because the subject site is exposed to train noise which is composed of loud single events, the City has additional criteria for maximum instantaneous noise levels (Lmax): 50 dB for bedrooms and 55 dB in other rooms.

Traffic Noise Impact on the Project Site

To quantify existing noise sources, two 24-hour measurements and three short-term (15 minute) measurements at the site were taken by Charles M. Salter Associates, Inc. in October 1997. Measurement locations were chosen to represent the proposed residential lots. The measurement locations are shown on Map 7-1, and the results of the measurements are shown in Table 7-1. As Table 7-1 indicates, the DNL varies from 63 to 65 dB at lots with line-of-sight to I-680. The DNL is less at Lot 12 because there is significant acoustical shielding from the existing terrain. **Since the DNL for Lots 3, 5, 6, and 9 ranges from 63 dB to 65 dB, and the City goal for backyards of single-family homes is generally 60 dB, this is considered a significant adverse impact.**

The short-term noise measurements indicate a daytime average noise level of 57 dB at Lots 6 and 9 which have a full view of I-680. The 24-hour DNL at these lots is 7 to 8 dB higher than the daytime



NOISE MEASUREMENT LOCATIONS
Oak Tree Farm
Phase III
PUD-97-01

Map 7-1
Not to Scale
Source: Charles M. Salter Assoc. Inc.

average noise level because of the 10 dB night time penalty used in the DNL descriptor. The reason this nighttime penalty has such a large effect on freeway noise is that, unlike residential streets, the freeway traffic does not decrease dramatically during the nighttime hours. Rather, it is near its highest during the early morning hours (before 7:00 am) which is penalized by 10 dB.

The 24-hour noise monitors indicate that maximum noise levels from train passbys were 73 to 76 dB. This level is likely due to brief whistle blasts. The train passbys generated noise events which lasted for at least 90 seconds (probably up to two to three minutes). Average noise levels during the train passbys were approximately 66 dB. According to the City's General Plan Noise Element, there are approximately 12 train passbys per day. Three or four of these train passbys are anticipated to be during the nighttime hours (10:00 pm to 7:00 am).

According to the General Plan Noise Element, the future traffic volume increase on I-680 would result in a noise increase of less than 1 dB. Train volumes would increase in the future due to the Altamont Pass Rail Demonstration Project. This would increase the train-generated DNL by 1 dB. Because the rail noise is a minor contributor to the DNL, this would not increase the overall noise exposure at the site.

Table 7-1
Noise Measurement Results

Location	Date/Time	A-Weighted Sound Level, dB				
		L_{eq}	L_{10}	L_{50}	L_{90}	DNL
A. Lot 3 10ft. above ground	28-29 Oct. 97 24 Hours	--	--	--	--	63
B. Lot 5 10ft. above ground	28-29 Oct. 97 24 Hours	--	--	--	--	63
C. Lot 6 5ft. above ground	28 Oct. 97 10-:20-10:30 am	57	58	56	55	64
D. Lot 9 5ft. above ground	28 Oct. 97 10:37-10:47 am	57	59	57	56	65
E. Lot 12 5ft. above ground	28 Oct. 97 10:50-11:00 am	49	51	48	46	57

Source: Charles M. Salter Associates, Inc.
NOTE: The locations indicated as A, B, C, etc. are shown on Map 7-1.
The DNL estimate is based on simultaneous measurement at 24-hour measurement location.

Construction Noise Impacts

During construction of the project, there will be short-term high noise levels. During the earlier phases of construction, noise will be generated by earth-moving equipment and may reach 80-85 dBA at a distance of 50 feet from the machinery. Short-term noise from intermittent construction activities will occur as individual sites are developed. The large size of the lots and the project site will help to

reduce the noise impacts. **These noise impacts are considered significant and unavoidable. The application of mitigation measures will reduce the level of these impacts to a less than significant level.**

7.3 MITIGATION MEASURES

Since the noise exposure at the project is a DNL of 65 dB or less, front yards of the homes would be considered acceptable without any additional noise mitigation. Back yards which are located directly behind the home will also have acceptable noise levels, (DNL 60 dB or less), because the home will provide at least 5 dB of acoustical shielding for the back yard. Lots 11 and 12 are located behind existing terrain which provides significant acoustical shielding and would not require additional measures to achieve the City's "normally acceptable" outdoor noise levels. Implementation of the following mitigation measures will reduce noise impacts related to traffic and train passbys to a less than significant level.

7.3.1 Mitigation Measure: If the major outdoor use area is located in front of the house (facing the freeway), adequate noise reduction can be achieved with a berm or fence (masonry or wood) which is just high enough to block the line-of-sight between the receivers in the back yard and the freeway. Because the residential lots are located above the freeway, this could be achieved with a fence of modest height (less than six feet), depending upon the actual geometry. For example, if the outdoor use space is level ground, then a 5-foot-high fence along its edge would block the line of sight between the receivers and the traffic on Interstate 680. If the fence is constructed out of wood, it should have a minimum surface density of 2 pounds per square foot. There should be no cracks or gaps either between boards in the fence or between the fence and the ground. The actual design of the wooden fence should be reviewed as a part of the acoustical study for that home or group of homes.

7.3.2 Mitigation Measure: Achieving the City's indoor noise criterion of DNL 45 dB will require the use of sound-rated windows in the closed position for some rooms. The appropriate sound ratings and locations should be determined by an acoustical consultant based on a review of the architectural design of the homes. This analysis should also address the City's single-event indoor noise for train passbys.

7.3.3 Mitigation Measure: All grading and construction activities shall occur only during the hours prescribed in the City's current standard conditions of approval.

Also, refer to Mitigation Measure 4.3.1 in the Land Use Chapter.

7.4 SIGNIFICANCE AFTER MITIGATION

Noise impacts will be less than significant.

CHAPTER 8: VEGETATION AND WILDLIFE

8.1 EXISTING SETTING

The following description of the existing setting is excerpted verbatim from the PD-89-17 SEIR, based on a report prepared for the Alameda County Planning Department by Harding Lawson Associates (HLA), entitled *Oak Tree Farm Biotic Resources Impact Analysis*, prepared June 1988" and from the *Oak Tree Farm Draft Environmental Impact Report* (Alameda County Planning Department, July 1988). Other references include a tree survey prepared by Thompson and Merrill (*Tree Survey, Oak Tree Farm* 1989), which includes a health evaluation of 253 trees prepared by HortScience. All reports are incorporated by reference and are available for review at the Alameda County Planning Department and the City of Pleasanton Planning Department.

The Oak Tree Farm project site supports oak woodland and grassland communities. The distribution of these communities is a function of soil moisture and topographic position. In the clay soils of the uplands, the driest sites are dominated by grassland, with solitary oaks scattered throughout. Tree density increases with proximity to draws, ravines and other relatively moist sites. A high water table and soil movement in some upland areas of the site appear to have excluded trees from becoming established.

The City of Pleasanton has adopted a "Heritage Tree Ordinance" (Chapter 17.16) which includes controls on removing specimen trees within the City limits. Many of the trees on-site would be considered heritage trees[6] under this ordinance. Map 8-1 shows the general locations of heritage trees that are near or on Lots 1 through 13. (Thompson and Merrill, 1989). Please refer to "Tree Survey for Oak Tree Farm" (Thompson and Merrill, 1989) for a full documentation of the heritage trees on site.

Following is a description of the community types and other biotic features found on the site. A complete list of plant and animal species observed or expected to occur on the project site is presented in Appendix II of the *Oak Tree Farm Draft Environmental Impact Report* (Alameda County Planning Department, July 1988).

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6 Per Section 17.16.006 of the Tree Preservation Ordinance, a "heritage tree" means any of the following: 1. Any single-trunked tree with a circumference of 55 inches or more measured 4.5 feet above ground level; 2. Any multi-trunked tree of which the 2 largest trunks have a circumference of 55 inches or more measured 4.5 feet above ground level; 3. Any tree 35 feet or more in height; 4. Any tree of particular historical significance specifically designated by official action; 5. A stand of trees the nature of which makes each dependent upon the other for survival or the area's natural beauty.

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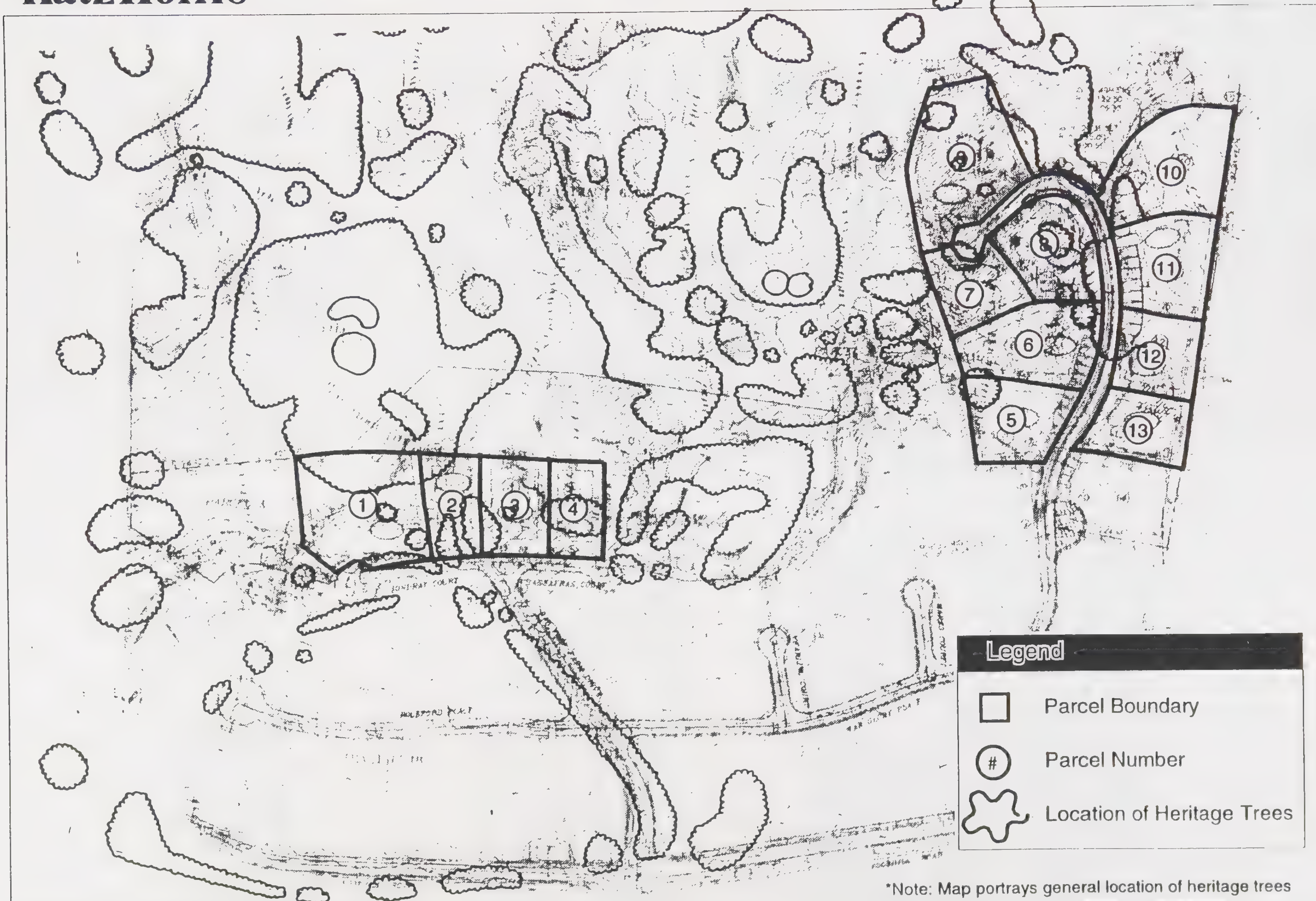

HERITAGE TREE LOCATIONS
Oak Tree Farm
Phase III
PUD-97-01

Map 8-1

Not to Scale
Source: Flempson and Merril and Hort Science, Inc., April 1989

Coast Live Oak Woodland

1. Vegetation

This community is widespread on the project site. Coast live oak (Quercus agrifolia) dominates this community, with valley oak (Q. lobata) occurring less frequently. Some of the oak trees on the site are of large size and could meet the City of Pleasanton's "heritage tree" classification (see Footnote 6 for a complete definition). Buckeye (Aesculus californica) also occurs sporadically throughout the site. The shrub layer is dominated by poison oak (Toxicodendron diversilobum) with coyote bush (Baccharis pilularis) occurring in lesser amounts. Tree density, species diversity, and understory vegetation becomes greater in and near the ravines and moist draws on the site. Bay trees (Umbellularia californica) are prevalent in these areas as well as shrubby understory vegetation including black hawthorn (Crateagus douglasii), western raspberry (Rubus leucodermis), elderberry (Sambucus mexicana), coffeeberry (Rhamnus californica), snowberry (Symphoricarpos mollis), and mule fat (Baccharis viminea). Except for the addition of bracken fern (Pteridium aquilinum) in the draws, ground cover in the woodland consists of the forbs and grasses found in the adjacent grassland.

2. Wildlife and Habitat

The vegetation of coast live oak woodland provides habitat and food resources for a wide variety of animals. Because of its areal extent and structural diversity, this community is valuable wildlife habitat. Deer, ground squirrel, red-shafted flicker, and acorn woodpecker utilize the acorn crop. Insectivorous birds such as nuthatches, titmice, and flycatchers glean insects from foliage and bark. Grosbeak, scrub jay, and quail inhabit the ecotone, or "edge" between the woods and the grassland. The omnivors raccoon, opossum, and striped skunk forage for insects and plant parts, while predators like the coyote and red fox search for carrion or prey. The canopy branches serve as roosting sites for turkey vultures or birds of prey, such as red-tailed hawk and kestrels.

Grassland

1. Vegetation

The grassland community vegetation is primarily herbaceous, although scattered clumps of poison oak and coyote bush occur infrequently. Non-native grasses and forbs such as melic grass (Melica sp.) and needle and thread grass (Stipa comata) are found scattered throughout the site. Native forbs with widespread occurrence include blue eyed grass (Sisyrinchium bellum), Ithurial's spear (Brodiaea laxa), and sopa root (Chloragalum pomeridianum).

2. Wildlife and Habitat

The structural uniformity of this one-layered community provides less habitat diversity and limits wildlife species to those adapted to life in herbaceous cover. The grassland habitat serves as an important seed, grain, root, and bulb resource for herbivores, which in turn serve as a prey base for the wider ranging predators nesting or roosting in the woodlands. Quail and western meadowlark feed on seeds and insects. Brush rabbit, jackrabbit, pocket gopher, western harvest mouse, mole, and ground squirrel forage in this habitat and serve as prey for the coyote, red fox, gopher snake, kestrel, and hawks.

Sensitive Species

No state or federally listed rare, threatened or endangered species are known to occur within the project site. According to the California Natural Diversity Data Base, there have been no reported occurrences of sensitive species in the immediate project site vicinity. No rare, endangered or threatened species were observed during the field reconnaissance conducted by HLA in October, 1987. Habitats on site were assessed as to their likelihood of supporting sensitive plant or animal species.

1. Vegetation

The California Native Plant Society (CNPS) has compiled a list of plant species of statewide concern organized by county. Within Alameda County, species of concern that could potentially occur on the project site include:

- adobe sanicle (Sanicula maritima)
- diamond-petaled California poppy (Eschscholzia rhombipetala)
- Diablo Helianthella (Helianthella castanea)

None of these species is federally listed and only the adobe sanicle is listed as rare by the California Department of Fish and Game. The diamond-petalled California poppy and Diablo helianthella are being considered for listing but currently have no official state or federal status.

The adobe sanicle was previously known from wet sites of heavy, adobe clay soil (Jepson, 1922) but can also occur on grassy hillsides. The only remaining known populations of this plant species are in San Luis Obispo County (R. York, personal comment) and it is reported as extirpated from Alameda County (Smith, 1984). It is therefore unlikely to occur on the project site.

Diamond-petaled California poppy is a California endemic species. It is known mostly from the grassy interior and eastern slopes of the Mt. Hamilton Range (Sharesmith, 1982) and the east base of the Mt. Diablo Range (Jepson, 1925). It is typically found on dry flats and brushy slopes in valley grassland, foothill woodland, and chaparral (Munz, 1973). Though foothill

woodland comprises a majority of the site, no dry flats or brushy slopes were observed in the project vicinity. Accordingly, this plant species is also unlikely to occur on the project site.

Diablo helianthella is also a California endemic and is considered endangered in a portion of its range which is confined to several populations in the San Francisco Bay Region. The species is typically found on grassy hillsides in foothill woodland habitats above 500 feet in elevation. This habitat type does occur on the project site. However, HLA has found that Diablo helianthella generally inhabits dryer, more open woodlands than those that occur in the project vicinity. Since Diablo helianthella is a perennial herb, its basal foliage can be observed prior to and following the April-May blooming period of the species. No individual plants suspected to be Diablo helianthella were observed during the October, 1987 field survey.

2. Wildlife

The Alameda whip snake and the San Joaquin kit fox are the only threatened animal species whose geographic range includes or borders the project site. Neither the Alameda whip snake nor its preferred habitat, dry coastal scrub bordering riparian woodland, was observed on the site. According to a previous study entitled, "Endangered Species Biological Assessment for the San Joaquin Kit Fox at Parks Reserve Forces Training Area, Pleasanton, California" completed in August 1983, the federally endangered San Joaquin kit fox ranges northeast of the project site near the Alameda/Contra Costa County border. Due to the proximity of kit fox range to the project site, the potential presence of this species was considered. Searching for signs of kit fox was integrated with the general field reconnaissance, however, no sign of kit fox was observed.

Conditions of Approval for PUD-89-17

Mitigation measures related to vegetation and wildlife included in the Conditions of Approval for PUD-89-17 apply to this project as well (note that the numbers below are the number of the condition in the Conditions of Approval for PUD-89-17). These measures include:

"17.a. Protect roots of heritage trees through measures suggested in the Heritage Tree Ordinance and the project landscape guidelines. A qualified biologist should be present during road grading activities to suggest and perform measures necessary to preserve trees.

17.b. No more than three additional heritage trees may be removed due to roadway grading and construction, building pad grading and other site preparation activities, not including landslide repair measures.

17.c. Lot 10: Removed trees shall be replaced at a six to one ratio with local native species, in a variety of sizes ranging from 15-gallon to 36-inch box. These trees shall be located along the westerly and northerly property lines to help screen the proposed house, provide privacy for the adjacent neighbor, and to re-establish the biotic balance of the tree stand. These trees shall be installed prior to occupation of the home.

17.d. All trees, but especially the heritage and smaller oak trees[7], shall be preserved to the greatest extent possible. Tree preservation measures shall be outlined in a Tree Preservation Plan, to be prepared by a qualified biologist, and approved by City staff. Where removal of trees for construction or grading for home sites is unavoidable, trees shall be replaced at a six-to-one ration, with the replacement trees to be a combination of native 15-gallon, 36-inch and 48-inch box trees. These trees shall be located so as to screen the proposed homes from view, and to re-establish any biotic relationships with the existing stands of trees from trees were removed.

17.e. In all cases where a heritage tree is incorporated within the lot and street landscaping of the development, or a heritage tree occurs immediately adjacent to a site designated for grading, no grading or vehicle soil compaction shall occur within four feet of the outer leaf circumference of the tree. Trees which are to be preserved shall have fences constructed around the entire tree at the dripline prior to grading and construction activities and shall be maintained through the duration of grading and construction activities. This zone shall be identified plainly by a series of four-foot high stakes flagged with orange tape and placed at 6 foot intervals around this zone. In addition, no high use human activities shall be placed under large heritage oaks (this restriction also shall be incorporated into the project landscape guidelines and homeowners' CC&Rs).

No root pruning within the dripline or crown pruning of any heritage trees to be affected by grading, landslide repair or building pad preparation shall occur.

17.f. All lots which have a downhill segment adjacent to heritage tree sites shall have a cement curb-type drain installed along the length of its border. Summer surface run-off water from lawn and yard watering shall be shunted by the curb drain to a storm water system and away from the root zone of the oaks. In addition, drought-resistant native landscaping shrubs and trees shall be used for the homesites, rather than water-demanding exotic species."

18. The entire development shall have a dog leash law enforceable through the CC&Rs, and walking of dogs shall be confined to street areas and common landscaped areas. No dogs shall be permitted in the remaining areas of natural open space (Lot A), particularly while running free. New home owners shall be made aware of the problems which free-roaming house cats can pose for wildlife species, and the hazards from predatory animals (coyotes and owls) which house cats may encounter. Home-owners shall be encouraged to maintain their cats in-house.

19. All two, three or four-wheeled vehicles shall be prohibited on any portion of the natural open space areas (Lot A) of the site."

Mitigation measures related to fencing impacts included in the Conditions of Approval for PUD-89-17 apply to this project as well. These measures include:

"84.f.i. Privacy fencing shall be of welded wire mesh screened with landscaping and shall not exceed 72 inches in height. Masonry block, slumpstone, etc. walls are not permitted.

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7 NOTE: Retaining all of the larger and older heritage oak trees on the site at the expense of younger, non-heritage trees could result in long term impacts to the entire oak tree population on the project site. Over a time period of 50 to 100 years, differential preservation of heritage trees is likely to lead to a reduction in the overall numbers, health and vigor of the oak tree population. If smaller, younger trees are always selected for removal, the population would be comprised mostly of older, mature trees and consequently, there would be an inadequate reserve of young trees to replace the trees that die or become diseased.

84.f.iii. Fencing for pools and tennis courts shall be of welded wire mesh, but must be screened by landscaping. Such fencing for pools must meet UBC requirements, but shall not exceed 72 inches in height.

84.f.iv. Fencing for tennis courts shall not exceed 12 feet. Opaque dark green panels may be installed in the interior side of such fences.

Mitigation measures related to lighting impacts included in the Conditions of Approval for PUD-89-17 apply to this project as well. These measures include:

84.g.i. A final site lighting plan shall be reviewed and approved by the Design Review Board prior to approval of the final map.

84.g.ii. The lighting plan should include "candlestick" type lights along the project streets, low poles with cut-off fixtures, and walkway type lights. All lighting shall be screened from Foothill Road.

84.g.iii. Tennis court lighting shall be directed downwards, and away from Foothill Road and adjacent residences. Said lights shall not exceed 15 feet in height. Mercury lights shall be prohibited.

84.g.iv. The developer shall submit a detail of the proposed street lighting for the project. The design of the street lights shall be approved by the City Engineer. If a lighting fixture is chosen that is not a PG&E standard, the homeowners shall pay the difference between the operating and maintenance charges between the selected light and the City standard light."

8.2 IMPACT ANALYSIS

Criteria for Significance

According to Appendix G of the CEQA Guidelines, a project would have a significant effect on biological resources if the project would: substantially affect a rare, threatened, or endangered species of animal or plant or the habitat of the species; interfere substantially with the movement of any resident or migratory fish or wildlife species; or substantially diminish habitat for fish, wildlife, or plants.

The proposed project would result in the subdivision of 13 lots and the construction of a total of 13 single family homes, with associated improvements for roadways and sidewalks. All of these units would be located on the hillside portions of the site. Landslide repair measures are required to create or protect these lots. Impacts to vegetation and wildlife would occur primarily as a result of site preparation and clearing activities, roadway construction, and landslide repair.

Coast Live Oak Woodland and Heritage Trees

For the most part, the proposed development plan has been sensitive to the oak woodlands and vegetated ravines by avoiding development in these areas. Roads and indicated building envelope areas have been situated to preserve heritage trees and other large stands of trees.

Heritage trees that might be affected by construction would be trees 245, 246 and 247, which are located in the northern portion of the site. **The above listed measures which are part of the project will reduce this potentially significant adverse impact to a less than significant level.**

The development plan attempts to locate building envelopes away from stands of trees and individual heritage trees, especially on most hillside lots. Notable exceptions to this are Lots 5, 10 and 11. The building envelope indicated for Lot 11 lies partially within the dripline of a tree group. Most of the middle of Lot 10 is covered with a stand of trees, one of which is a heritage tree (#235, Coast Live Oak) located at the westerly property line. It seems impossible to place a home on this site without removal of some trees. However, removal of the trees will cause the lot and home to be quite visible. As some of the trees are located towards the rear of the site, removing them would create a clear view of the site from adjacent residences. Additionally, removing a number of trees which are part of a stand creates impacts throughout the remaining trees. **This is considered a significant, unavoidable adverse impact.**

The majority of vegetation impacts would occur due to landslide repair activities. Map 5-2 indicates the areal extent of buttresses needed for landslide repair, and indicates also areas of active landslides that would need to excavated and recompacted. At least 17 heritage trees, all but one of which are Coast or Valley Oak, would need to be removed. Substantial amounts of vegetation located at the toe of the hill slope would have to be removed. Much of this vegetation is located around the central ravine drainage and is of biological significance, as it provides wildlife habitat. **Removal of heritage trees and this vegetation is considered a significant, unavoidable adverse impact.**

The amount of vegetation removal indicated above assumes that the areal extent of landslide repairs is not extended during further geotechnical investigations or field repair work. As part of the mitigation of impacts related to geology, the area indicated on Map 5-2 for buttressing, excavation and recompaction may become larger, which could affect more trees and vegetation. If this occurs, additional heritage trees would be removed, almost all vegetation along the toe of the slope would be removed, and the symbiotic integrity of large stands of trees would be jeopardized. **The potential for removal of substantial additional amounts of vegetation is considered a potentially significant environmental impact.**

Wildlife

Direct and indirect impacts to wildlife would occur primarily as a result of habitat loss. As described above, various wildlife species are associated with each of the vegetation communities. Direct impacts would include the loss of food sources. For example, the main food source of the gray squirrel--oak acorns--would be reduced through removal of coast live oak woodland. Gray squirrels would subsequently be either displaced or eliminated from the project site. Indirect impacts on predators also would occur because of the reduced opportunity for preying on organisms found in either coast live

oak woodland or grassland. Predatory wildlife species including red-tailed hawk and coyote, likely would be displaced to nearby hunting areas, or reduced in number because of reduced numbers of prey.

Indirect impacts on the remaining undisturbed habitat and associated wildlife would result from the intrusive presence of future residents and structures around and within the undeveloped portions of the site. Native wildlife species are impacted when domestic cats and dogs chase or prey on them.

Habitat loss and reduction of on-site wildlife is considered a potentially significant impact.

8.3 MITIGATION MEASURES

Refer to Mitigation Measure 4.3.1 in the Land Use and Planning Chapter.

8.4 SIGNIFICANCE AFTER MITIGATION

After implementation of mitigation measures, impacts to heritage trees, removal of substantial amounts of vegetation, habitat loss and reduction of on-site wildlife will be considered significant and unavoidable.

CHAPTER 9: IMPACT CONCLUSIONS

9.1 Unavoidable Impacts

The following is a summary of those project-related impacts identified in Chapters 4 - 8, which would be unavoidable or potentially unavoidable despite implementation of mitigation measures recommended in the SEIR.

A. Visual Impacts

Short-term impacts related to construction and landslide repairs is significant and unavoidable.

The loss of heritage trees is a significant, unavoidable impact.

The permanent loss of scenic open space due to development of the property is unavoidable.

B. Noise

Construction noise impacts are significant and unavoidable.

Noise impacts from traffic on I-680 are unavoidable, but less than significant with implementation of mitigation measures.

C. Vegetation and Wildlife

Intrusion of human and domestic animal activities and residential land uses into the remaining undisturbed wildlife and vegetative habitat is an unavoidable impact.

9.2 Short Term Uses and Long Term Productivity

The following section is excerpted from the Draft Environmental Impact Report for Oak Tree Farm (Alameda County Planning Department, July 1988).

"The CEQA Guidelines require a description of the cumulative and long-term effects of the proposed project which adversely affect the environment. Special attention should be given to those impacts which narrow the range of beneficial uses of the environment or pose long-term risks to health and safety

The proposed project would have short-term effects on the environment that include grading and excavation of visible portions of a Pleasanton Ridge hillside, grading and excavation (due to landslide repair) of potentially unstable slopes, and loss of vegetation due to grading activities and construction of homes in existing natural open space areas. Proposed mitigation measures, and project alternatives, do address short term environmental impacts, except for the unavoidable loss of open space and change in landscape character and land use due to development. Only the no-project alternative would avoid these impacts, and then only in the short term.

The cumulative long term effects of the project include the following:

1. Disturbance of highly visible portions of the lower Pleasanton Ridge view shed with excavated landslides, building sites, roadways and single-family homes.

2. The construction of single-family homes and roadways with the potential for geologic hazards.

3. Loss of a unique visual resource and land use...

The loss of vegetation due to grading and landslide repair, and the continuation of residential development would have a long-term negative effect on vegetative and wildlife resources in this area. Permanent disturbance of visible portions of the lower Pleasanton Ridge view shed can be mitigated partially with sensitive re-contouring of hillsides and re-vegetation. However, the long term transformation of the site from rural to suburban would be irreversible."

9.3 Growth-Inducing Impacts

The site of the proposed project is adjacent to park lands to the south and west. These lands are held by the East Bay Regional Park District and it is unlikely that development would occur on these lands in the future. Across Foothill Road to the south and east, the land along the Arroyo is owned by the San Francisco Water Department. Again, it is unlikely that this land would be developed due to the terrain, potential for flood hazard and other issues which may make these lands infeasible to develop in the near future. So, even though utilities would be extended to the project site, extending these utilities would not encourage additional growth on undeveloped lands south and west of the project site.

To the north, land is developed already with low-density suburban residences. A nine-lot subdivision has been approved by Alameda County across Foothill Road to the east, and construction is underway. Development of these lots requires extension of services in Foothill Road and a sliver widening of the street on the east side of Foothill Road. No further development may occur on this site, as it carries a low-density zoning and General Plan designation.

In sum, the project would not create direct pressure for additional residential growth in the area.

9.4 Cumulative Impacts

The following is excerpted from the Draft SEIR for Oak Tree Farm (Alameda County Planning Department, July 1988).

> "While some identified impacts of the proposed development are relatively insignificant alone, they are consequential when considered cumulatively with other planned and future development in the area and region. These cumulative impacts include:
>
> 1. Loss of mature native vegetation and associated wildlife.
>
> 2. Loss of scenic open space."

CHAPTER 10: PROJECT ALTERNATIVES

10.1 Introduction

CHAPTER 10: PROJECT ALTERNATIVES

10.1 Introduction

The CEQA Guidelines [Section 15126(d)] require that an EIR describe and evaluate the comparative merits of a range of reasonable alternatives to the proposed project, or to the project's location, which would attain most of the basic objectives of the project. Case law further defines reasonable alternatives as those that "may be 'feasibly accomplished in a successful manner' considering the economic, environmental, social and technological factors involved." (*Citizens of Goleta Valley v. Board of Supervisors* 52 Cal.3d 553, 556 [276 Cal. Rptr. 410]. The Guidelines further require that the discussion focus on alternatives capable of avoiding or substantially lessening significant effects of the project. Also, the No Project alternative must be discussed as a baseline for comparison. If the environmentally superior alternative is the No Project alternative, the EIR also must identify an environmentally superior alternative from among the other alternatives.

The term "environmentally superior" refers only to the comparative *environmental* effects of the proposed project and alternatives. The project objectives, and whether a particular alternative meets the objectives, must also be considered in the evaluation of alternatives. An alternative may be "environmentally superior" to the proposed project, but the alternative may not meet most of the basic objectives required to make the project feasible as defined by the lead agency. Such an alternative would be considered infeasible in accordance with CEQA Guidelines Section 15126(d). Therefore, environmental impacts and project objectives must be carefully weighed by decision-makers before an informed decision can be made.

This chapter describes two alternatives to the proposed project. As required by CEQA, this chapter addresses the No Project Alternative. The "Alternative Site" option is not discussed, as this is not a feasible alternative: the project proponent cannot acquire a similarly-sized piece of property in a similar location within the vicinity.

According to the CEQA Guidelines and CEQA case law:

The discussion of alternatives need not be exhaustive, and the requirement as to the discussion of alternatives is subject to a construction of reasonableness. The statute does not demand what is not realistically possible given the limitations of time, energy, and funds. 'Crystal ball' inquiry is not required. *Residents Ad Hoc Stadium Committee v. Board of Trustees* (3d Dist. 1979) 89 Cal. App. 3d 274,286 [152 Cal.Rptr 585]; see also CEQA Guidelines, Section 15126(d)(5); and *Foundation for San Francisco's Architectural Heritage v. City and County of San Francisco* (1st Dist. 1980) 106 Cap. App. 3d 893,910 [165 Cal. Rptr. 401].

The range of feasible alternatives shall be selected and discussed in a manner to foster meaningful public participation and informed decision making...An EIR need not consider an alternative whose

effects cannot be reasonably ascertained and whose implementation is remote and speculative. [CEQA Guidelines, Section 15126 (d)(5)]

The No Project alternative, required by law to be considered in the EIR, must include a description of "existing conditions, as well as what would be reasonably expected to occur in the foreseeable future if the project were not approved, based on current plans and consistent with available infrastructure and community services" [Section 15126(d)(4)].

The Environmental Setting description in Chapters 4 through 8 for each impact area describes existing conditions. Throughout the SEIR, including for the alternatives, the environmental setting is used as the baseline against which potential impacts are analyzed.

10.2 No Project Alternative

The California Environmental Quality Act (CEQA) requires a discussion of the No Project alternative. In this case, that would be no construction of the 13 additional single-family homes on the site that constitutes Phase III of the Oak Tree Farm subdivision. Phases I and II, a total of 38 units, have been approved for the site (PUD-89-17) and are under construction. With the No Project alternative, only the 38 units would be built, and the rest of the site would remain vacant.

The City's General Plan indicates that the Oak Tree Farm property is designated for Rural and Low Density Residential uses, which would permit up to 92 units. The General Plan also encourages average densities on a citywide basis, which theoretically could limit development on this site to 51 units. In any case, more than 38 units would be permitted on this site. Without a General Plan amendment changing the land use residential designation, it is reasonable to expect that additional residential development will occur on this site. It also is reasonable to expect that any future development would have a similar build-out and similar impacts. Disapproval of this project implies a rejection of the development concept proposed by the applicant, rather than a disapproval of a single-family residential development for which the property has been designated. The No-Project Alternative most likely would be a temporary condition as market demands and development pressure most likely would result in another development proposal.

The City of Pleasanton land use regulations provide for more intense development of the project site than currently exists, and assumes that some form of single-family residential development is the ultimate and intended use of the area. Therefore, the No Project alternative may be environmentally superior, but may not be necessary or desirable because some development of the site may meet the City's General Plan policies.

There are key impacts which could be avoided <u>in the short-term</u> with the No-Project Alternative:

1. Visual Impacts - no loss of remaining open space and open space (hillside) views; no alteration to the existing landscape character; no changes in topography.

2. Vegetation and Wildlife Impacts - no loss of existing vegetation or wildlife habitat in the hillside portions of the site.

3. Noise Impacts - eliminated on selected project residences; short-term construction noise eliminated.

4. Grading/Geologic Impacts - eliminated due to landslide repair measures, and grading required to produce building sites; landslide hazard to potential homes eliminated.

Given the history of approvals of other, similar projects on the west side of Foothill Road, it is not reasonable to expect continued support of the No Project alternative. Although this alternative would avoid any significant adverse environmental impacts in the short-term, it is not considered to be a realistic alternative in the long term.

10.3 Reduced Number of Lots Alternative #1

With this alternative, Lots 7 through 11 would be eliminated from the site plan, reducing the total number of lots for Phase III from 13 to 8. This would be an environmentally superior alternative, since it would require less disturbance of the natural terrain, create less of a visual impact from off-site, alleviate noise impacts on residents at Oak Tree Farm, and create less of an impact on vegetation and wildlife.

The key impacts which would be avoided or minimized are:

1. Land Use - the total number of lots for all three phases (46) would be below the General Plan average density and holding capacity.

2. Visual Impact - less severe transformation of the landscape; no homes and appurtenant structures on the hillsides visible from Foothill Road, I-680 or from other areas of the Ridge.

3. Vegetation and Wildlife - substantial reduction in vegetation removal; retention of wildlife habitat.

5. Noise Impacts - fewer project residences would be affected by environmental noise; the noisiest lots were those on the hillsides on the northern portion of the site.

6. Grading\Geologic Impacts - less grading due to site development; substantially less grading and earthwork due to landslide repair; less need to disturb areas with potential for slope failure; less potential for triggering landslides during repairs.

10.4 Reduced Number of Lots Alternative #2

With this alternative, Lots 1 through 4 would be eliminated from the site plan, reducing the total number of lots for Phase III from 13 to 9. This would also be an environmentally superior alternative, since it would require less disturbance of the natural terrain, create less of a visual impact from off-site, and create less of an impact on vegetation and wildlife.

The key impacts which would be avoided or minimized are:

1. Land Use - the total number of lots for all three phases (47) would be below the General Plan average density and holding capacity.

2. Visual Impact - less severe transformation of the landscape; fewer homes and appurtenant structures visible from Foothill Road, I-680 or from other areas of the Ridge.

3. Vegetation and Wildlife - reduction in vegetation removal; retention of wildlife habitat.

4. Grading\Geologic Impacts - less grading due to site development; less need to disturb areas with potential for slope failure; less potential for triggering landslides during repairs.

10.5 Environmentally Superior Alternative

Following review of the above alternatives, the No Project and both of the Reduced Number of Lots alternatives seem to be environmentally superior to the proposed project.

APPENDIX A

INITIAL STUDY, RESPONSES TO NOTICE OF PREPARATION

CITY OF PLEASANTON

INITIAL STUDY
ENVIRONMENTAL CHECKLIST FORM

I. BACKGROUND

A. Name of Proposal: PUD -97-01
Oak Tree Farm Phase III

B. Project Proponent: Currin Construction Company

Contact Person: Patrick Currin

C. Address: 8272 Sassafras Court
Pleasanton, CA 94566

Phone: (510) 462-3740

D. Date Checklist Submitted: August 15, 1997

E. Person Preparing Checklist: Kathryn Watt, Associate Planner
City of Pleasanton

II. POSSIBLE ENVIRONMENTAL IMPACTS

This project proposes the construction of 14 single-family detached custom homes on approximately 13.5 acres of a 91-acre site. The site is located on the west side of Foothill Road, south of Country Lane. An EIR for a planned unit development (PUD) proposal for 68 lots previously was certified and a 55-lot project was approved on this site, with a requirement for additional geotechnical studies for some of the hillside lots. New studies prepared in 1992 did not satisfy the requirements and 17 hillside lots of the 55-lot plan were not approved as part of the project's vesting tentative map. New geotechnical information now has been presented, triggering the need to recirculate pertinent information from the previous EIR (SCH #90030991), and the new information in one document.

Zoning for the property is PUD -- RDR/LDR (Planned Unit Development -- Rural Density Residential/Low Density Residential).

A. Conformance of Proposal with General Plan Policies.

The project conforms with the General Plan land use designations for the site of Rural Density Residential (1 unit per every 5 acres) and Low Density Residential (less than 2 units per acre). The total number of lots already approved (38) and those now being applied for (14) conforms to the overall allowed density for the site. Amenities have been included within the project to conform to General Plan policies.

______	___X___	______
May be Significant	Insignificant	Insignificant if Mitigated

B. Impact on Existing Uses (On and Off Site)

Existing on-site uses are primarily residential in nature, although some agricultural structures still are located on the property for storage use. The upper portion of the site is limited to open space uses through a recorded conservation easement, with a pedestrian/equestrian trail which also functions as an emergency vehicle access into the hillside area. Areas to the north are improved with older residential uses, to the east with newer residences, and the site is surrounded on the south and west by the Pleasanton Ridge Regional Park, owned and operated by the East Bay Regional Park District. About 40 acres of open space and several rear yards of approved homesites abut the Park.

______	___X___	______
May be Significant	Insignificant	Insignificant if Mitigated

C. Geologic Impacts (Hazards, Change in Topography, Erosion, etc.)

The Calaveras fault trace is postulated to be about 1200 feet upslope of the property buried by landslide deposits. Much of the western, hillside portion of the site is underlain by massive landslide deposits which are suspected of becoming unstable during seismic activity. The proposed 14 lots are located in areas of the site which were previously determined by the City to be unsuitable for habitable structures. Subsequent studies performed in 1996 and 1997 indicate that the slopes may be more stable than previously determined. Grading for slope stabilization procedures may be necessary. Grading in these areas will be necessary to extend roads and create building pads.

___X___	______	______
May be Significant	Insignificant	Insignificant if Mitigated

D. Air Quality Impacts (Emissions, Odors, Change in Microclimate)

The proposed residential development would result in small, incremental increases in emissions due to building heating/cooling and vehicular usage. Residential development would be subject to the City's growth management policies, which are consistent with the area-wide air quality management plan. Construction activity on the site will be subject to dust control measures.

______ May be Significant	__X__ Insignificant	______ Insignificant if Mitigated

E. Water Related Impacts (Runoff, Flood Hazard, Quality and Quantity of Surface and Ground Waters)

Runoff would increase as a result of more intensive use of the property. There is evidence that a significant amount of run-off occurs in the northern, hilly portion of the site and some drainage improvements have been made as the result of development. Additional drainage system improvements may be necessary and will be subject to City review and standards. Residential development would result in the introduction of urban pollutants to surface runoff typical of that found in other similar residential areas, but hazardous substances are not expected. The flood hazard maps of the Federal Emergency Management Agency (FEMA) indicate that the project site is not located within a flood-prone area.

__X__ May be Significant	______ Insignificant	______ Insignificant if Mitigated

F. Plant and Animal Impacts (Effect on Existing Ecosystem, Rare or Endangered Species, etc.)

There are no known endangered species of flora or fauna known to inhabit the project site. The upper reaches of the site are characterized by scattered oaks and areas of heavy brush, mostly poison oak. Ornamental planting will be introduced in conjunction with the proposed development. There may be some removal of heritage trees and other vegetation through project grading or grading needed for landslide repair or stabilization.

__X__ May be Significant	______ Insignificant	______ Insignificant if Mitigated

G. Transportation/Circulation Impacts (Additional Traffic, Congestion, Parking, Hazards, etc.)

The proposed project would generate about 140 vehicle trips per day (ADT). This is a negligible increase which would not significantly affect traffic volumes or levels of service on adjacent streets or intersections, all of which are fully developed. Street improvements on Foothill Road were required and are under construction to alleviate identified impacts with construction of the approved 37 new homes. These improvements are sufficient to accommodate the additional trips.

______ May be Significant	___X___ Insignificant	______ Insignificant if Mitigated

H. Noise Impacts (Increases, Exposure to High Levels)

Noise from Interstate 680 is apparent in the upper portions of the site, where about 10 of the 14 new lots are proposed. Noise levels in the rear yards of these home may exceed the City's General Plan levels. House siting, yard locations, and fencing may alleviate these impacts.

___X___ May be Significant	______ Insignificant	______ Insignificant if Mitigated

I. Impacts on Public Services (Fire, Police, Schools, Parks, Maintenance, etc.)

Incremental increases in the demand for public services will occur as a result of the proposed development. The developer has contributed a pro-rata share to required fire-fighting and police equipment related to the site's location in a high fire hazard area and its open space. Additional contributions will be required if the proposed project is approved. Remaining police, fire, school, park, and related service capacities exist to adequately serve the project.

______ May be Significant	___X___ Insignificant	______ Insignificant if Mitigated

J. Impact on Utilities (Water, Sewer, Storm Water Drainage, Solid Waste, etc.)

Services already have been extended to this area in conjunction with development of the lower portion of the site. Additional residential development will require an extension of

sewer mains and other utilities already located on-site, subject to specific conditions and City design standards.

May be Significant	Insignificant	Insignificant if Mitigated
	X	

K. Growth-Inducing Impacts

The site already has been developed, or is being developed, with 37 new single-family homes and necessary in-tract streets and utilities. Areas to the north of the site have been developed with single-family residences for several decades. Because the property is surrounded by the Pleasanton Ridge Regional Park on the south and west, additional urban growth in these directions is limited.

May be Significant	Insignificant	Insignificant if Mitigated
	X	

L. Energy Impacts

Residential development will be subject to local and State energy conservation standards. An incremental increase in the amount of energy resources will be consumed if 14 new homes are approved.

May be Significant	Insignificant	Insignificant if Mitigated
	X	

M. Aesthetic Impacts (Obstruction of Views, Design, etc.)

Construction of 14 new homes in the hillside areas of the site could result in visual changes to the current open hillside and natural topography that could be visible from Foothill Road, I-680, and adjacent properties.

May be Significant	Insignificant	Insignificant if Mitigated
X		

N. Impacts on Archaeological or Historical Sites

No known archaeological or historical sites are present on the subject site or in its vicinity. City policy requires appropriate mitigation should such a site be found.

___ May be Significant	_X_ Insignificant	___ Insignificant if Mitigated

	Yes	No
O. Is there any serious public controversy concerning the environmental effects of the proposed project? If so, list below.	___	_X_

III. MANDATORY FINDINGS OF SIGNIFICANCE

	Yes	No
A. Does the project have the potential to degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self sustaining levels, threaten to eliminate a plant or animal community, reduce the number or restrict the range of a rare or endangered plant or animal or eliminate important examples of the major periods of California history or prehistory?	___	_X_
B. Does the project have the potential to achieve short-term, to the disadvantage of long-term, environmental goals? (A short-term impact on the environment is one which occurs in relatively brief, definitive period of time while long-term impacts will ensure well into the future.)	___	_X_

	Yes	No
C. Does the project have impacts which are individually limited, but cumulatively considerable? (A project may impact two or more separate resources, where the impact on each resource is relatively small, but where the effect of the total of those impacts on the environment is significant.)	___	X
D. Does the project have environmental effects which will cause substantial adverse effects on human beings, either directly or indirectly?	___	X

IV. STAFF RECOMMENDATION

___ I find the proposed project would not have a significant effect on the environment and, thus, recommend a Negative Declaration be prepared.

___ I find that the mitigation measures recommended in the Initial Study for those aspects of the project which could have a significant effect would reduce the effects to insignificant levels and, thus, if such measures are included as conditions to project approval, I recommend a Negative Declaration be prepared.

X I find the proposed project may have a significant effect on the environment, and, thus, recommend an Environmental Impact Report be prepared.

Date 2 Sept. 1997 Signature Kathyrn Watt

(otf3is.sam)

LOCATION MAP

PUD-97-01: Oak Tree Farm, Phase III

Scale 1" = 400'

Governor's Office of Planning and Research
1400 Tenth Street
Sacramento, CA 95814

DATE: September 11, 1997

TO: Reviewing Agencies

RE: OAK TREE FARM PHASE III
SCH# 97092040

Attached for your comment is the Notice of Preparation for the OAK TREE FARM PHASE III draft Environmental Impact Report (EIR).

Responsible agencies must transmit their concerns and comments on the scope and content of the NOP, focusing on specific information related to their own statutory responsibility, within 30 days of receipt of this notice. We encourage commenting agencies to respond to this notice and express their concerns early in the environmental review process.

Please direct your comments to:

KATHRYN WATT
CITY OF PLEASANTON
200 OLD BERNAL AVENUE
P.O BOX 520
PLEASANTON, CA 94566-0802

with a copy to the Office of Planning and Research. Please refer to the SCH number noted above in all correspondence concerning this project.

If you have any questions about the review process, call Kristen Derscheid at (916) 445-0613.

Sincerely,

Antero A. Rivasplata

ANTERO A. RIVASPLATA
Chief, State Clearinghouse

Attachments

cc: Lead Agency

97092040

97092040

NOP Distribution List

SCH# ____________

S = sent by lead agency
X = sent by SCH

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[ ] **Mike Falkenstein**
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Regional Water Quality Control Board

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707/576-2220 Fax 707/523-0135

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[ ] **CENTRAL COAST REGION (3)**
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[ ] **LOS ANGELES REGION (4)**
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[ ] **CENTRAL VALLEY REGION (5)**
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( ) **Victorville Branch Office**
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Palm Desert, CA 92260-2564
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[ ] **SANTA ANA REGION (8)**
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619/467 2952 Fax 619/571-6972

[X] OTHER Housing

[ ] OTHER

SCH 7/8/97

REGIONAL PARKS

EAST BAY REGIONAL PARK DISTRICT

October 14, 1997

RECEIVED
OCT 16 1997
CITY OF PLEASANTON
PLANNING DEPT

Kathryn Watt, Associate Planner
City of Pleasanton Planning Department
P. O. Box 520
Pleasanton, CA 94566-0802

RE: PUD-97-01 - Oak Tree Farm Phase III

Dear Ms. Watt:

This is in response to your letter of September 2, 1997, regarding the Notice of Preparation for an EIR for residential development at Oak Tree Farm. We are providing the following comments on this project for consideration in the EIR.

Visual impact: Given that the proposed project area is currently undeveloped, construction of the project may have significant visual impacts which may be disruptive to the users of the trails in the adjacent Pleasanton Ridge Regional Park. This impact should be addressed in the EIR. If significant impacts to trail users occur, we request to be consulted regarding the adequacy of potential mitigation measures.

Slope Stability: As stated in the NOP, the area is known for previous slope instability, and grading and cuts and fills will be required for roads and building pads. The EIR should address how any potential landslides caused by this grading and cuts and fills could affect Pleasanton Ridge Regional Park.

Open Space: The project description mentions areas of open space. Are these to be formally dedicated? Will they be held publicly or privately, and if publicly, which agency would be responsible for management?

Traffic: This project is near our Pleasanton Ridge Regional Park staging area on Foothill Road. This is the Park's only staging area. The EIR should address the issue of increased traffic on Foothill Road potentially affecting the safe use of this staging area.

2950 Peralta Oaks Court P.O. Box 5381 Oakland, CA 94605-0381 Tel: (510) 635-0135 TDD: (510) 633-0460 Fax: (510) 569-4319

Thank you for the opportunity to provide comments on this project. If you have any questions regarding these comments, please contact Susan Canale, Resource Analyst, at 510-635-0138 extension 2603. Please forward a copy of the draft EIR upon its completion and any other notices regarding this project.

Sincerely,

Brad Olson
Environmental Specialist

SJC

cc: Susan Canale
Martin Vitz

APPENDIX B

AGENCIES, PERSONS AND REFERENCES CONSULTED

APPENDIX B
EIR PREPARERS, AGENCIES, PERSONS, AND REFERENCES CONSULTED

A. Preparers of EIR

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B. Persons Consulted

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200 Old Bernal Avenue
Pleasanton, CA 94566-0802

Mr. Roger Higdon, Assistant Public Works Director
City of Pleasanton
200 Old Bernal Avenue
Pleasanton, CA 94566-0802

Mr. Harold Goldberg, PE
Charles M. Salter Associates, Inc.
130 Sutter Street
San Francisco, CA 94104

C. Documents Consulted

The City of Pleasanton General Plan (City of Pleasanton, 1996)
nton by: TJKM Transportation Consultants, May 1991)

Growth Management Report (City of Pleasanton, 1991)

Oak Tree Farm, Draft EIR
(prepared by: Alameda County Planning Department, July 1988)

Tree Survey, Oak Tree Farm
(prepared for Currin Construction Company by: Thompson and Merrill and HortScience, Inc., April 1989)

Oak Tree Farm (PUD-89-17) Draft Supplemental Environmental Impact Report (SCH#90030991) (City of Pleasanton, 1991

Oak Tree Farm (PUD-89-17) Final Supplemental Environmental Impact Report (SCH#90030991) (City of Pleasanton, 1991

Stability Analyses of Ancient Landslide Oak Tree Farm (November 1996) (Document included in Appendix C) (Prepared for the Currin Construction Company by Kleinfelder)

Oak Tree Farm Architectural and Landscape Design Guidelines (August 25, 1992)
(Prepared for the Currin Construction Company by Dommer & Byars and Merrill & Associates)

The following documents prepared by TerraSearch, Inc. for Currin Construction Company:

Geotechnical Feasibility Evaluation on Oak Tree Farm Development (July 1986)

Geohydrologic Investigation on Oak Tree Farm Development (May 1987)

Additional Subsurface Data on Oak Tree Farm Development (December 1987)

Geotechnical Investigation on Oak Tree Farm Development (November 1990)

Description of Landslide Mitigation on Oak Tree Farm (July 1991)

Geologic and Geotechnical Update for Analysis of Hillslope Lot Development Oak Tree Farm (November 1996) (Document included in Appendix C)

APPENDIX C

GEOTECHNICAL ANALYSES

The following documents are included in this appendix:

<u>Stability Analyses of Ancient Landslide Oak Tree Farm,</u> November 25, 1996, Kleinfelder, Inc.

<u>Geologic and Geotechnical Update for Analysis of Hillslope Lot Development Oak Tree Farm</u>, November 19, 1996, Terrasearch Inc.

Letter from Alan Kropp & Associates, Inc. dated December 9, 1996. (Regarding an assessment of the conclusions in the above listed documents)

Letter from Alan Kropp & Associates, Inc. dated February 26, 1997. (Regarding an assessment of the conclusions in the above listed documents)

STABILITY ANALYSES OF ANCIENT LANDSLIDE
OAK TREE FARM (TRACT 6898)
FOOTHILL ROAD
PLEASANTON, CALIFORNIA

KLEINFELDER

An employee owned company

DRAFT

Prepared for **Currin Construction Company**

STABILITY ANALYSES OF ANCIENT LANDSLIDE
OAK TREE FARM (TRACT 6898)
FOOTHILL ROAD
PLEASANTON, CALIFORNIA

November 25, 1996
File No.: 10-3004-64

November 25, 1996
File No. 10-3004-64

Mr. Bill Currin
Currin Construction Company
8015 Foothill Road
Pleasanton, California 94566

SUBJECT: Stability Analyses of Ancient Landslide, Oak Tree Farm (Tract 6898), Foothill Road, Pleasanton, California

Dear Mr. Currin:

We are pleased to submit our draft report containing results of our slope stability and deformation analyses for the existing landslide at Oak Tree Farm (Tract 6898) hillside development on Foothill Road in Pleasanton, California. Additional copies have been transmitted as indicated below. We will finalize the report following receipt of your comments on the draft. The enclosed report provides a description of the investigation performed and our conclusions on stability of the slope and its impact on the proposed residential development. The static stability analysis is performed using limit equilibrium technique. For dynamic stability, a pseudo-static method with limit equilibrium technique, and deformation study using nonlinear finite element analysis have been performed by us.

Based on our study, we believe that the existing ancient landslide is stable from static loading condition. The landslide will also remain stable from earthquake shaking associated with a lower level seismic event, with higher probability of occurrence at the site. At a higher level earthquake event, which has a return period of about 500 years, minor slope deformation is expected. The level of deformation is not excessive and may be tolerated by the proposed improvements when properly designed.

The conclusions and recommendations presented in this report are based on subsurface data collected by Terrasearch, Inc., the geotechnical engineer of this project. Our involvement for this project was to analyze the stability condition of the ancient deep-seated landslide only, and did not include stability of the recent shallow slides within the project site.

KLEINFELDER 7133 Koll Center Parkway, Suite 100, Pleasanton, CA 94566-3101 (510) 484-1700 (510) 484-3838 fax

We appreciate the opportunity of providing our services to you on this project and trust this report meets your needs at this time. If you have any questions concerning the information presented, please contact this office.

Sincerely,

KLEINFELDER, INC.

Samia Ara, C.E.
Project Engineer

Michael Majchrzak, C.E., G.E.
Senior Geotechnical Engineer

SA/MM/mjt

cc: Mr. Roger Higdon / City of Pleasanton
Mr. Alan Kropp / Alan Kropp & Associates
Mr. Simon Makdessi / Terrasearch, Inc.

DRAFT

STABILITY ANALYSES OF ANCIENT LANDSLIDE
OAK TREE FARM (TRACT 5629)
FOOTHILL ROAD
PLEASANTON, CALIFORNIA

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OAK TREE FARM (TRACT 5629)
FOOTHILL ROAD
PLEASANTON, CALIFORNIA

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PLATES

DRAFT

STABILITY ANALYSES OF ANCIENT LANDSLIDE
OAK TREE FARM (TRACT 5629)
FOOTHILL ROAD
PLEASANTON, CALIFORNIA

I. INTRODUCTION

This report presents the results of our slope stability and deformation study of the existing deep-seated ancient landslide underlying the western portion of the Oak Tree Farm Residential development in Pleasanton. This report discusses potential impact of the ancient landslide on the proposed single family housing development. The original geotechnical investigation for this project was performed by Terrasearch, Inc. (Terrasearch), and was reviewed initially in 1992 by Berlogar Geotechnical Consultants (BGC), the reviewer for the City of Pleasanton at that time. The project has been on hold since 1992. Kleinfelder was recently retained to perform an independent evaluation of stability of the ancient landslide using current techniques of which are widely accepted by the profession. Our study is based on the results of field and laboratory data obtained by Terrasearch. During the course of our study we have met with Terrasearch, and Allan Kropp and Associates (AKA), the present reviewer for the City of Pleasanton for this project, to obtain their concurrence on the parameters used, and our analysis and conclusions.

II. PROJECT DESCRIPTION

The project site is located in the western portion of Pleasanton about 0.6 miles north of the southern city limits, and is approximately 500 feet south of Castlewood Country Club. The location of the site is along the west side of Foothill Road near the intersection with Verona Road. The approximate location of the site is shown on Plates 1 and 2. The extent of our study is to evaluate the stability of an ancient landslide that underlies the sloping topography of the Oak Tree Farm development and extends uphill beyond the limits of the property. A number of custom lots will be constructed along the lower portion of Pleasanton Ridge, an area believed to be underlain by an ancient deep seated landslide. The average inclination of the entire existing

slope is on the order of 4:1 (horizontal to vertical). Elevations for the slope varies between approximately 300 and 1,250 feet. The proposed lots will be located along the lower portion of the slope, between approximate elevations of 300 and 500 feet. The Calaveras fault crosses the subject slope approximately along the top portion, and is about 1,500 feet west of the development area.

This portion of Pleasanton is within the eastern slope of the Pleasanton Ridge of the East Bay. The eastern portion of the current Oak Tree Farm development is in a relatively flat area adjacent to Foothill Road. Development of this relatively flat area has begun within the construction of a number of singe family homes and associated streets. Consideration is now being given to adding lots to be developed at the toe of the existing slope and on the slopes in the northern portion of the property. As presented on the site map, Plate 3, the development for this project is planned in two different clusters, consisting of a total of four lots at the toe of the existing slope near the middle portion of the site, and another ten lots to the north end of the property. Roadways and courts will be constructed to provide access to the lots. These streets will require minor cuts and fills to acquire the final grades. The lots will maintain the existing slopes and minimal grading is planned within the lots itself.

The hillside to be developed is covered with vegetation consisting of grass with closely to widely scattered oak trees. Some areas of the slope also contain patches of dense brush and undergrowth.

III. BACKGROUND

Terrasearch is the geotechnical engineer-of-record for this project. The original geotechnical investigation for the entire project, which included the proposed lots for this project and also development within the flat land areas east of the hillside, was performed by Terrasearch, and the results of the investigation was presented in a report dated November 16, 1990. Based on the results of their field investigation laboratory testing and geologic studies, an ancient landslide was estimated to extent for the base of the hillside at a depth of about 80 feet, to about 4,000 feet up

the slope. The estimated maximum depth of the landslide is over 100 feet deep in the mid portion of the landslide. Following submittal of the reports, the proposed lots within the flat land portion were developed. However, potential instability of the ancient landslide and its impact on the hillside lots were still in question, and further studies were warranted prior to development within this area.

A supplemental study for the evaluation of the stability of the ancient landslide was later performed by Terrasearch, the results of which are presented in their report dated July 8, 1992 and revised on August 4, 1992. As part of that study, additional soil borings and continuous logging of core samples were performed to better establish the geometry of the ancient slide. Based on the results of radiocarbon testing on a wood grain obtained from landslide debris, the landslide appears to be at least 40,000 years old, and possibly much older. The wood grain was from a Coast Redwood, which normally grows in a cooler and wetter climate than the present. At 40,000 years ago, according to Terrasearch, the valley floor was greater than 40 feet below its current level; the stream within the valley floor is actually depositing soil rather than eroding it. Combining the lower depth of the valley with the anticipated higher groundwater levels, the ancient landslide most likely occurred during a large seismic event. Based on the information from the borings performed by Terrasearch, the level of groundwater has since fallen to much deeper than 100 feet throughout most of the landslide area.

A detailed slope stability analysis was performed by Terrasearch in 1992 to evaluate the stability of the existing landslide under static as well as seismic conditions. Seismic stability analyses were performed using a pseudo-static approach. Soil strength properties were estimated from laboratory strength data obtained from tests performed on samples, collected from the landslide slide plane zone. Based on the results of their stability analyses, Terrasearch concluded that the ancient landslide is stable under static and seismic loading conditions and it is safe to construct residences within the hillside lots.

Following the submittal of the landslide evaluation report, BGC, the reviewer for the city, expressed concerns regarding the apparent stability of the ancient landslide. The dispute

expressed by BGC on stability had not yet been resolved, and the City of Pleasanton delayed approval of the development of the proposed lots until stability of the ancient landslide could be established through further evaluations.

IV. PURPOSE

The purpose of our study was to evaluate the stability of the existing ancient landslide underlying the proposed hillside development lots. We have used limit equilibrium method to evaluate the static stability of the subject landslide. For the dynamic stability evaluations of the landslide, two different methods were used. The first method consists of a pseudo-static analysis using limit equilibrium method, while the second method consisted of non-linear-effective stress finite element deformation analysis. The finite element deformation approach is a more sophisticated approach that evaluates the landslide as a composite of small elements rather than as one entire block for which the pseudo-static analysis is based on. This approach, at present, is considered to be the most precise way of estimating deformation for a slope.

In lieu of performing the dynamic stability for an estimated maximum credible seismic event at the site, our approach was to look into the problem from a performance stand point. Considering probability of occurrence of various levels of earthquake at the site, we selected two levels of seismic events for this project. The selected risk levels are described later in this report. For evaluation of dynamic stability using the pseudo-static analysis, we have reviewed various research papers and publications on this subject. Our review also concentrated on evaluation of proper strength properties to be used in static as well as dynamic evaluation of the slope.

During the course of our study our approach was to frequently meet with the project design team consisting of Terrasearch, Kleinfelder, and Allan Kropp and Associates, the reviewer for the City, and discussed our findings up-to-date. This has been extremely helpful in concluding various issues in a timely fashion.

In particular our scope of work for this project as follows:

- Review of available geotechnical and geologic reports
- Research for appropriate increase in strength parameters and seismic coefficient to be used in dynamic analyses
- Evaluation of appropriate strength properties for slope deformation analyses
- Seismic risk analysis for design level earthquake, and evaluation of seismic coefficient for stability evaluation
- Stability analyses of ancient landslide
- Development of time history for deformation analysis
- Deformation analyses using finite element approach
- Meetings with City reviewer
- Submission of final report with details of finding

V. LITERATURE SEARCH

Our literature review consisted of research of available publications with respect to improvements on estimating the seismic coefficient for pseudo-static stability evaluation of slopes, and selection of appropriate strength parameters for use in evaluation of existing landslides. Our research for this project consisted of:

- Review of various pertinent reports and research papers available in our files.
- Review of the research papers furnished to us by Allen Kropp and Associates.
- Review of research papers available at the Earthquake Engineering Research Center Library at the University of California, Berkeley.
- Telephone discussions with a number of researchers well known in the field.
- Review of the internet to collect available information on the above subjects.

The research papers and publications that were reviewed for this project are presented in the "Reference Section" in Appendix A.

VI. SEISMIC COEFFICIENT FOR PSEUDO-STATIC SLOPE STABILITY ANALYSIS

The pseudo-static approach involves determination of a factor of safety against sliding through limit equilibrium techniques when an inertial force is applied to the slope. This inertial force is represented by the product of the seismic coefficient and weight of the sliding mass. Although it has been established by researchers that this is a simplification of a very complex process, and in fact is very conservative, nevertheless, at present, it is the most common tool of analysis in the industry.

Until recently, the selection of a seismic coefficient has relied heavily on engineering judgment and local code requirements because there has not been a simple method for establishing an appropriate value. A peak horizontal ground surface acceleration (PGA), typically estimated for sites using acceleration attenuation relationships, which correlates PGA with earthquake magnitude, closest distance to causative fault and soil type, is not representative of the inertial force and should not be used as a seismic coefficient (CDMG, 1996). In California many state and local agencies require the use of a seismic coefficient of 0.15, and a minimum computed factor of safety of 1.1 to 1.2 for pseudo-static analyses of natural, cut, and fill slopes. As suggested by CDMG (1996), in the absence of local guidelines, it may be possible to estimate an appropriate seismic coefficient using the methods proposed by Ashford and Sitar (1994), which was employed in our analysis.

According to Ashford and Sitar (1994), the average equivalent seismic coefficient (k_{av}) for use in a limit equilibrium pseudo-static analysis of a steep slope to estimate a minimum factor of safety against sliding may be estimated through the following steps as follows:

- Estimate the free field peak ground surface acceleration behind the crest of the slope through either probabilistic methods or one-dimensional site response studies.

- Increase the free field peak ground surface acceleration by 50 percent to account for the effect of sloping topography.

- Estimate variation of maximum equivalent seismic coefficient (k_{max}) with depth using the relationship proposed by Seed and Makdisi (1978). The upper bound values should be used for steepest slopes and average values should be used for shallower slopes.

- Multiply the k_{max} value by 0.65 (Seed and Martin, 1967) to convert the equivalent maximum acceleration to an average seismic coefficient (k_{av}) for the analysis.

VII. SOIL STRENGTH PARAMETERS

We performed a literature research to obtain information on recent developments on selection of appropriate soil strength parameters for use in static and dynamic stability evaluation of existing landslides.

For static analysis of existing landslides, the general practice is to use the residual strength properties of the slide mass. The concept of residual strength has contributed greatly toward understanding the long-term shearing resistance that can be mobilized in clay slopes (Stark, 1995). Skempton (Skempton, 1977) concluded that slopes that have undergone 1 or 2 meters of displacement should be designed using a drained residual strength. Therefore, the drained residual strength pertains to slopes that contain pre-existing shear surfaces, such as old landslides. These statements are confirmed by CDMG (CDMG, 1996), which states that the residual test values should be used for static analysis of existing landslides, along shale bedding planes, highly distorted bedrock, over-consolidated fissured clays, and for paleosoils and topsoil zones under fill.

A number of residual strength tests were performed by Terrasearch on samples of soils collected from the shear zone on the ancient landslide. A summary of shear strength test results performed by Terrasearch on representative samples collected from the shear zone is presented in Table 1, at the end of this section. These tests obtained residual properties with friction values ranging between 15 and 31 degrees, with cohesion intercept of zero (Terrasearch, 92). Terrasearch concluded that because of the age of the landslide, the slide plane material has high degree of consolidation and healing over time and would, therefore, possess cohesive properties. They further stated that due to the high overburden pressure that exist at the slide plane, high cohesion values are normally expected. On the basis of empirical data a cohesion value of 300 pounds per square foot (psf) was estimated for static analyses.

Considering the above facts, we have performed static stability analysis of the ancient landslide using a residual strength values for the slide plane material. The sensitivity of the slope performance has been investigated by varying the friction angle of slide plane material from 15 to 25 degrees, for cohesion values of zero and 300 psf. Details of our stability analyses are presented in the "Slope Stability Analysis" section of this report.

For a dynamic condition, since the duration of loading is relatively short, the use of residual strength is not prudent. Peak values may be used for pseudo-static or dynamic analyses if the build-up of pore pressure is not anticipated. CDMG (1996) suggests that consideration to reducing the peak strength values should be made in light of the findings of Makdisi and Seed (1978), who recommend the use of 80% of the undrained shear strength for soils that exhibit small increases in pore pressure during cyclic loading, such as clayey soils, dry and partially saturated cohesionless soils, or very dense saturated cohesionless materials.

The laboratory test results of the shear plane material (Terrasearch, 1992), in conjunction with our knowledge on estimating dynamic properties, as presented above, were used to estimate the appropriate strength values for dynamic analysis of the ancient landslide. As reported by Terrasearch, a total of five samples collected from the shear zone were tested in their laboratory. Four of the samples were tested at a slow strain rate of 0.016 inches/ minutes. The friction values

obtained from these tests varied between 14 and 41 degrees, with cohesion ranging between 2,100 to 6,400 psf. The fifth sample was tested at much faster rate, 0.05 inches/minutes to simulate short term seismic conditions. The sample had a friction value of 14 degrees with a cohesion value of 7,800 psf. For our dynamic analyses, a friction value of 15 to 20 degrees were established for the slide plane material. The cohesion value was conservatively estimated to vary between 2,000 and 4,000 psf.

TABLE 1 SUMMARY OF SHEAR STRENGTH TEST RESULTS

Boring	Depth (ft.)	Material Description	Shear Strength Peak	Shear Strength Residual
A	30	tan brown silty clay	C=2100 psf $\phi=15°$	C=0 $\phi=15°$
40	82.5	dark gray blue silty clay	C=2100 psf $\phi=21°$	C=0 $\phi=26°$
41	106	dark gray blue silty clay	C=7800 psf $\phi=14°$(1)	
41	107	dark gray blue silty clay	C=4600 psf $\phi=14°$	C=0 $\phi=15°$
42	83.5	dark gray blue silty clay	C=4000 psf $\phi=41°$	C=0 $\phi=31°$

Note: (1) Sheared at fast strain rate

VIII. LANDSLIDE CONFIGURATION

A representative section designated as Section 12-12 was established through the landslide mass to cross the proposed north cluster of lots that have been selected for our analysis. The location of the section is presented on Plates 2 and 3. The ground surface profile along the section has been adopted from USGS topographic map.

Previous slope stability studies by Terrasearch concentrated on one representative section (Section 6-6) within the middle portion of the ancient landslide, which is approximately 1000 feet to the south of Section 12-12, and representative of section through the south cluster of lots. A

number of deep soil borings, including one large diameter boring, were performed along Section 6-6 to clearly identify the depth of shear plane. Based on their studies the slide plane was estimated to extent for about 4,000 feet upslope from the toe of the slope. The slide plane was assumed to be over 100 feet deep near the middle portion.

Soil borings performed near Section 12-12 were not adequately deep to establish the slide plane along this section. During a project meeting with Terrasearch and Allan Kropp, the ground surface profile for Sections 6-6 and 12-12 were compared with the intent of using slide plane for Section 6-6 as the representative slide plane for Section 12-12. Considering the similarity of the two profiles, and the extensiveness of the large ancient landslide, it was concluded that landslide plane along Section 6-6 with minor modification with any available information should represent the slide plane along Section 12-12. One deep boring performed by Terrasearch, Boring B-52, was located towards the top portion of the section. The information obtained from this boring indicated that base of slide plane at this location may be as deep as 130 feet below ground surface. Considering this the landslide was made deeper at the upper portion of the landslide which made it more conservative than Section 6-6 from stability stand point. To further evaluate the depth to slide plane, as well as groundwater condition within the slide area, a new boring was drilled in this area. Plate 4 shows the cross section (Section 12-12) analyzed for this project, along with the approximate extent of the proposed improvement area and the lots to be crossed by this section. Due to the fact that this section would entail conservative results as compared to Section 6-6, the results of this study may effectively be applicable for the south cluster of proposed lots.

IX. SEISMIC RISK ANALYSIS

A.

The purpose of seismic risk analysis is to develop site specific ground motion criteria in terms of peak ground accelerations and design response spectra for the subject site to be used in the seismic stability analyses of the slope. Peak ground accelerations are needed in pseudo-static analyses, whereas, response spectra are required to select appropriate earthquake time histories

for nonlinear dynamic analyses of the slope. The above mentioned ground motion criteria was established by using a seismic source model (proximity of active faults, major historical earthquakes, regional seismicity) and subsurface soil conditions at the site. The response spectra is a graphical representation relating the maximum response of a single degree of freedom, elastic damped oscillator with different fundamental periods of dynamic loads. Site-specific spectra for any given return period represents uniform-risk earthquake ground motions consistent with the seismic source model and the local site response.

B. Faulting

The proposed development area is located in a region which is traditionally characterized by high seismic activity. The Calaveras fault traverses the landslide roughly in the upper middle portion of the subject slope. The housing development site is located approximately 0.6 km east of the active Calaveras Fault and approximately 12.1 km east of the active Hayward fault. A major seismic event on these faults could cause significant ground shaking at the site. Other faults located close to the site, where earthquakes may result in significant ground shaking at the site, include: the Greenville-Marsh Creek fault, approximately 19.7 km to the east, the Concord fault, approximately 29 km to the north, the Coast Ranges - Sierran Block Boundary (also known as Midland fault zone), approximately 33.5 km to the northeast, the San Andreas fault, approximately 40.6 km to the west, the Green Valley fault, approximately 51.7 km to the northeast, the San Gregario fault, approximately 53.3 km to the southwest, the Sargent-Berrocal fault, approximately 56.1 km to the southwest, and the Rodgers Creek fault, approximately 76 km to the northwest.

The above faults that are capable of producing strong ground motions at the subject site are listed in Table 2 along with appropriate parameters used for this analysis. Locations of the active and potentially active faults in the area with respect to the subject site are shown on Plate 5. The location of the faults and associated parameters presented in Table 2 are based on data presented by Real et. al. (1978), Toppozada et. al. (1978), Harwood and Helly (1982), Wesnousky (1986), Wong et. al. (1988), Working Group on California Earthquake Probabilities (1990), Schwartz

(1994), Jennings (1994), Mualchin (1995), Petersen et. al. (1996), and Frankel et. al. (1996). The maximum earthquake magnitudes presented in this table are based on the moment magnitude scale developed by Kanamori (1977).

TABLE 2: SIGNIFICANT FAULTS

Fault Name	Fault Length (km)	Closest Distance to Site (km)	Magnitude of Maximum Earthquake *	Slip Rate (mm/yr.)	Values of	
					a	b
Calaveras	75	0.60	6.8	6	3.90	0.90
Hayward	80	12.1	7.3	9	3.10	0.80
Greenville - Marsh Creek	56	19.7	6.9	2	2.99	0.90
Concord	26	29.0	6.9	6	2.98	0.80
Coast Ranges- Sierra Block Boundary (also known as Midland)	560	33.5	7.0	1.5	4.41	1.20
San Andreas	420	40.6	7.9	24	3.32	0.70
Green Valley	45	51.7	6.9	6	2.88	0.80
San Gregario	70	53.3	7.3	5	2.47	0.70
Sargent-Berrocal	29	56.1	6.8	3	1.64	0.70
Rodgers Creek	60	76.0	7.1	9	2.54	0.70

* moment magnitude

The “a” and “b” value listed in this table is a measure of the frequency of occurrence of earthquakes of various magnitudes. The general form of this recurrence model is based on the Gutenberg-Richter (Gutenberg and Richter, 1956) exponential frequency-magnitude relationship:

$$\log N(M) = a - bM$$

where N(M) is the cumulative number of earthquakes of magnitude "M" or greater per year, and "a" and "b" are constants based on recurrence analyses.

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C. Seismicity

The project site and its vicinity are located in an area traditionally characterized by high seismic activity. A number of large earthquakes have occurred within this area in the past years. Some of the significant nearby events include the 1906 (M8+) San Francisco earthquake, the 1838 (M7) San Francisco earthquake, the 1836 (M7) Hayward earthquake, the 1868 (M6.8) Hayward earthquake, the 1955 (M5.4) Concord earthquake, the 1957 (M5.3) Daly City earthquake and the 1989 (M6.9) Loma Prieta earthquake. Epicenters of some significant earthquakes (M>4.0) within the vicinity of the site are shown on Plate 5.

The earthquake data base used contains in excess of 5,500 seismic events and covers the period from 1800 through October 1996. The earthquake data base is principally comprised of an earthquake catalog for the State of California prepared by the Division of Mines and Geology (CDMG). The original CDMG catalog (Real, et. al, 1978) is a merger of the University of California at Berkeley and the California Institute of Technology instrumental catalogs (Hileman, et. al, 1973). The combined catalog contains earthquake records from January 1, 1900 through December 31, 1974. Updates prepared by CDMG in 1979 and 1982 extend the coverage through 1982. In addition to the CDMG updates, the data for more recent earthquakes for period between December 1974 and June 1996 have been obtained from several other sources, including the California Institute of Technology, the University of California at Berkeley, the University of Nevada at Reno, and the Earthquake Data Base System of the U. S. Geological Survey. The earthquake data base also consists of earthquake records between 1800 and 1900. This subset of the earthquake data base was derived from Seeburger and Bolt (1976) and Toppozada, et. al (1978, 1981).

The parameters used to define the limits of the historical earthquake search include geographical limits (within 100 km of the site), dates (1800 through October 1996), and magnitudes (M>4). A summary of the results of the historical search is presented below.

Time Period (1800 to 1996)	197 years

Maximum Magnitude	8 +
Approximate distance to nearest historical earthquake	7.5 km
Number of events exceeding magnitude 4 within search area	227

D. Site Characterization

In developing site specific seismic design criteria, the characteristics of the soils underlying the site are an important input to evaluate the site response at a given site. The characterization of the site at the top of the slope behind the crest is needed to develop peak ground acceleration for the pseudo-static analysis. In addition, the characterization of the site at the bedrock level is also required to develop the design response spectra for the selection of earthquake time history to be used in the dynamic analysis.

The results of test borings performed by others at this site indicate that the subsurface conditions at the site, in general, consists of a landslide mass of alluvium over bedrock. The thickness of the alluvial layer is up to about 100 feet. The alluvium generally consists of very stiff to dense deposits. Based on this and our estimation of shear wave velocities within the alluvium, we can classify the soil profile at the top of the slope behind the crest as Site Class B according to Boore et. al. (1993). Site Class B is defined as a soil profile consisting of very stiff soils or soft rock with shear wave velocity ranging from 260 m/s to 750 m/s within the top 30 meters of the profile.

E. Seismic Risk

Two levels of ground motion criteria were established by us for this project - a Lower Level Earthquake (LLE) and Upper Level Earthquake (ULE). The LLE is defined as the ground motion that has a 50% probability of being exceeded in 50 years (return period of about 72 years) and ULE is defined as the ground motion that has a 10% probability of being exceeded in 50 years (return period of about 475 years).

<u>Attenuation Relationship</u>

Site response can be influenced by the styles of faulting, magnitudes of the earthquakes, and the local soil conditions. The attenuation relationships used to estimate ground motion from an earthquake source at some distance from the site need to consider these effects.

Many attenuation relationships have been developed to estimate the variation of peak ground surface acceleration with earthquake magnitude and distance from the site to the source of an earthquake. Of these relationships, we have selected relationship presented by Boore et. al. (1993,1994) because of its wide acceptance by seismologists. This relationship has also been used in developing recent Interim National Seismic Hazard Maps (Frankel et. al., 1996) for the State of California. Since the site can be classified as Site Class B according to Boore et. al. (1993, 1994), we have used the relationship that corresponds to the Site Class B. The predictive relationships by Boore et. al. (1993, 1994) were developed from statistical analyses of recorded earthquakes from Western North America, including the records from the 1989 Loma Prieta earthquake, and 1992 Landers earthquake. The attenuation relationships provide mean values of ground motions associated with one set of parameters: magnitude, distance, site soil conditions, and mechanism of faulting. The uncertainty in the predicted ground motion is taken into consideration by including a magnitude-dependent standard error in the probabilistic analysis.

Probabilistic Analysis

Probabilistic modeling procedure was used to estimate the peak ground motions corresponding to the design level earthquakes. The probabilistic analysis approach is based on the characteristics of the earthquake and of the causative fault associated with the earthquake. These characteristics include such items as magnitude of the earthquake, distance from the site to the causative fault, maximum credible earthquake, length, and activity of the fault. The effects of site soil conditions and mechanism of faulting are accounted for in the attenuation relationships.

The theory behind the seismic risk analysis has been developed over many years (Cornell, 1968, 1971; Merz and Cornell, 1973) and is based on the "total probability theorem" and on the

assumption that earthquakes are events that are independent of time and space from one another. According to this approach, the probability of exceeding PE(Z) at a given level of ground motion, Z, at the site within a specified time period, T, is given by

$$PE(Z) = 1 - e^{\vartheta(Z)T}$$

where $\vartheta(Z)$ is the mean annual rate of exceedance of ground motion level Z. Different probabilities of exceedance may be selected, depending on the level of performance required.

Peak Ground Surface Acceleration

The estimated peak horizontal ground surface accelerations (in units of gravity), calculated using the method discussed above for two events are presented in Table 3. The corresponding return period and annual probabilities of occurrence are presented in the same table.

TABLE 3 PEAK GROUND ACCELERATION

Event	Return Period	Annual Probability of Exceedance	Probability of Occurrence	Peak Horizontal Acceleration (g)
LLE	72	0.0139	50% in 50 years	0.30
ULE	475	0.0021	10% in 50 years	0.55

X. SLOPE STABILITY ANALYSIS

We performed static and pseudo-static stability analyses, using limit equilibrium method, to evaluate the minimum factor of safety against slope failure under static and seismic conditions. The slope stability analysis was performed using computer code XSTABL, developed by Interactive Software Designs, Inc., using Spencer's method. The slope section which was analyzed is shown on Plate 4. The soil strength parameters used in these analyses are as follows:

Static Condition

C = 0	∅ = 15°	C = 300 psf	∅ = 15°
C = 0	∅ = 17.5°	C = 300 psf	∅ = 17.5°
C = 0	∅ = 20°	C = 300 psf	∅ = 20°
C = 0	∅ = 22.5°	C = 300 psf	∅ = 22.5°
C = 0	∅ = 25°	C = 300 psf	∅ = 25°

Dynamic Condition

C = 2,000 psf	∅ = 20°
C = 3,000 psf	∅ = 20°
C = 4,000 psf	∅ = 20°
C = 3,000 psf	∅ = 15°

For pseudo-static analyses, the seismic coefficient was estimated using the approach recommended by Ashford and Sitar (1994). The peak ground surface accelerations at the site, as stated earlier in the report, are estimated to be 0.55g and 0.3g for the upper and lower level seismic events, respectively. For the upper level event, the seismic coefficient is calculated as follows:

$$(0.55g)\,(1.5)\,(0.6)\,(0.65) = 0.32g$$

Where 0.55g is the peak ground surface acceleration, 1.5 is the multiplier to convert the level ground acceleration to a crest acceleration at the top of slope (Ashford and Sitar, 1994), 0.6 is the coefficient for conversion of crest acceleration to an equivalent maximum acceleration within the slide mass (Makdisi and Seed, 1978), and 0.65 is the multiplier to convert the equivalent maximum acceleration to an average seismic coefficient (Seed and Martin, 1967). Similarly the pseudo-static coefficient for the lower level seismic coefficient is estimated to be 0.18g.

Based on the boring information performed by Terrasearch, a permanent groundwater table within the development area has been found at a depth significantly below the landslide plane. Perched water was encountered in a few borings performed by Terrasearch during drilling and the holes were dry at conclusion of drilling. Terrasearch installed a number of piezometers to monitor groundwater level within the slide area. These piezometers are significantly deep, extending as deep as 200 feet below the ground surface. Previous and recent groundwater measurements taken from these piezometers did not encounter groundwater, thus indicating the true groundwater to be significantly deep, and below the base of the slide plane.

To account for all possible groundwater conditions for the ancient landslide, and to evaluate the potential impact of the various levels of groundwater on the stability, we have assumed five different groundwater conditions within the slope. The location of these five tentative groundwater surfaces are presented on Plate 6 as Groundwater Levels A, B, C, D, and E. A brief description of each groundwater condition is summarized below.

- Groundwater A (GW-A): is located approximately 30 feet above the slide plane downslope of the fault line, and 30 feet below the ground surface upslope of the fault line. This groundwater corresponds to the level of perched water encountered in a few borings. This condition also considers the fact that the a fault may be acting as impermeable zone which allows the groundwater to back-up upslope of the fault zone. This case is the most conservative of all levels analyzed.
- Groundwater B (GW-B): is located approximately 20 feet above the slide plane downslope of the fault line, and 30 feet below the ground surface upslope of the fault line.
- Groundwater C (GW-C): is located approximately 30 feet above the slide plane along the entire slip surface.
- Groundwater D (GW-D): is located approximately 10 feet above the slide plane along the entire slip surface.

- Groundwater E (GW-E): is located below the slide plane. From the recent data obtained from the piezometers, this condition is considered to be the most representation of the existing condition at the site.

Using the estimated slide plane (as shown on Plate 4) and various strength parameters, and groundwater conditions (as described above), we performed a series of slope stability analyses using computer code XSTABL to conclude the minimum factor of safety against slope failure. The factor of safety against failure for the predefined slide plane was calculated using Spencer's method. The results of our slope stability analyses for both static and dynamic conditions are presented on Tables 4 and 5, respectively.

TABLE 4 RESULTS OF STABILITY ANALYSIS (STATIC CONDITION)

		Factor of Safety				
		GW-A	GW-B	GW-C	GW-D	GW-E
C = 0	$\phi = 15°$	1.01	1.05	1.08	1.17	1.22
	$\phi = 17.5°$	1.19	1.24	1.27	1.38	1.44
	$\phi = 20°$	1.38	1.43	1.46	1.60	1.66
	$\phi = 22.5°$	1.57	1.63	1.60	1.81	1.89
	$\phi = 25°$	1.76	1.83	1.83	2.04	2.12
C =300 psf	$\phi = 15°$	1.14	1.18	1.18	1.30	1.35
	$\phi = 17.5°$	1.32	1.36	1.36	1.51	1.56
	$\phi = 20°$	1.50	1.55	1.55	1.72	1.78
	$\phi = 22.5°$	1.69	1.75	1.75	1.94	2.01
	$\phi = 25°$	1.89	1.95	1.95	2.17	2.25

TABLE 5 RESULTS OF STABILITY ANALYSIS (DYNAMIC CONDITION)

		Factor of Safety									
		GW-A		GW-B		GW-C		GW-D		GW-E	
C (psf)	ϕ (deg.)	LLE	ULE	LLE	ULE	LLE	ULE	LLE	ULE	LLE	ULE
2000	20	1.19	0.87	1.22	0.89	1.24	0.90	1.32	0.96	1.36	0.99
3000	20	1.42	1.03	1.45	1.06	1.47	1.07	1.56	1.14	1.60	1.17
4000	20	1.65	1.20	1.68	1.23	1.70	1.25	1.79	1.31	1.83	1.34
3000	15	1.23	0.90	1.25	0.92	1.27	0.92	1.33	0.97	1.36	1.00

Note: Pseudo-static coefficient for lower level event (LLE) is 0.18g, and for upper level event (ULE) is 0.32g.

Plates 7 and 8 present the results of stability analyses for two different cohesion parameters (C=0, and C=300 psf). Plate 9 is the combination of these two plates, and compares the results obtained for the two cohesion values. Plate 10 presents the calculated yield acceleration to initiate deformation as obtained from the pseudo-static analyses. For a given strength and groundwater condition, if the calculated yield acceleration is above the pseudo-static coefficient for a given level of seismic condition (i.e.,. when the point on the graph falls to the right of the vertical seismic coefficient line), the slope is considered to be stable under the same seismic condition. On the other hand, when pseudo-static coefficient is higher than the yield acceleration, the slope will undergo deformation. The magnitude of deformation will be related to the ratio of these two numbers. For a set of conservative strength properties and groundwater conditions (C=2,000 psf, and ϕ = 20 degrees, Groundwater Condition GW-A) the calculated yield acceleration is .25g. This value is higher than the pseudo-static coefficient for the lower level seismic event, thus indicating a factor of safety greater than 1.0 for the stability of the slope. However, the calculated yield acceleration is lower than the estimated coefficient for the upper level event. This will initiate deformation of the slope at such event. Using Makdisi and Seed (1978), a rough estimate of deformation along the slide plane is estimated to be 1 to 2 inches.

Report of results obtained from our slope stability analyses are included in the Appendix B of this report.

XI. DEFORMATION ANALYSIS

A. Development of Earthquake Time History

Time histories are required for the dynamic analysis of slope for the assessment of permanent deformations in the slope during a seismic event. Selection of time history requires geologic and seismologic characterization of potential seismic sources. According to Green (1992) the most important parameters describing ground motions for use in the evaluation of slopes are the response spectrum and duration of shaking. The time histories can either be selected from recorded motions or generated synthetically. In both cases the response spectrum of the selected time history should "roughly" match with the design spectra developed from the risk analysis.

The site-specific design response spectra for this project were developed based on a uniform-risk approach. The uniform risk approach assumes that the same level of risk is uniformly applied to the entire response spectra. Response spectral values for the two levels of ground motions for 5 percent damping were calculated using the same probabilistic analysis approach, described above. The predictive relationship for pseudo-relative velocity response spectra (horizontal component) by Boore et. al. (1993, 1994) was used to attenuate the ground motions from the source to site. The resulting uniform-risk response spectra in linear form for LLE and ULE are presented on Plate 11, and in tripartite form are presented on Plate 12. The spectral acceleration values (in units of gravity) for the two levels of ground motions for 5 percent damping were listed on Table 3.

It should be noted that the time histories from an actual earthquake are often synthetically altered to match the design spectrum. The philosophy behind this approach is that the actual time histories are often deficient in terms of spectral energy in some frequency ranges and through spectra match procedure these deficiencies can be eliminated to provide a more conservative time

history. However, this may not be true for some cases because the spectra matching technique alters the spectral energy of the actual time history by increasing the energy in some frequency ranges and decreasing in other frequency ranges to match the design spectrum. Based on the above information and the fact that the Calaveras fault, with a maximum moment magnitude M6.8 associated with it, is the closest fault from the proposed site, the recording from Loma Prieta (M6.9) earthquake at Corallitos station (90° component) located at a distance of about 5 km from the epicenter was selected for our analysis for the ULE. We have used both the actual time history and loosely spectra matched time history in our analyses. The time history was spectra matched in frequency domain using procedures described by Singh (1986). The actual Corralitos, and spectra matched time histories (acceleration, velocity and displacement) are presented on Plates 13 and 14, respectively. Their spectra are presented on Plates 15 and 16.

For lower level event (LLE), we selected two different earthquake records, the University of California at Santa Cruz (90° component), and the Joshua Tree Firestation (0° component), both representative of comparable magnitude and distance. One of these records were slightly modified to match the target spectra. The time histories and respective spectra are presented on Plates 17 to 20.

All of the time histories were base line corrected in time domain to be used in the dynamic analyses of the slope.

B. Finite Element Deformation Analysis

The seismic stability and deformation of the subject landslide underlying the proposed development area were evaluated using a two-dimensional plane strain nonlinear effective stress finite element code (FLAC) and an elastoplastic constitutive soil model based on Mohr-Coulomb failure criterion. This type of analysis is, generally, preferred over more conventional pseudo-static type analyses using Newmark's rigid block method for estimating slope deformations under seismic loading condition.

An idealized cross section of the slope used in the deformation analyses is shown on Plate 4. It consists of an approximately 4,000 feet long slope section underlain by landslide deposits consisting of intermixed clay, silt, sand and gravel overlying bedrock. The thickness of this deposit ranges from almost nothing at the top of the slope to up to 100 feet along the middle portion of the slope to about 20 to 30 feet at the toe of the slope.

The soil properties used in our deformation analyses are presented in the "Soil Strength Parameters" section of this report, and are listed in Table 6 below. These properties have been estimated from the results of field investigations and laboratory tests performed by Terrasearch.

TABLE 6 SOIL PROPERTIES USED IN DEFORMATION ANALYSIS

Unit weight	135 pcf	135 pcf	135 pcf	135 pcf
Cohesion	2,000 psf	3,000 psf	4,000 psf	2,000 psf
Friction Angle	20 deg	20 deg	20deg	15 deg
Tensile strength	0	0	0	0

The initial stiffness were estimated from the strength parameters and the Poisson's ratio was set at 0.35.

The finite element mesh used to represent the idealized cross section for slope deformation analyses is shown in Appendix C. The mesh consists of approximately 500 material zones which are connected by grid points. Free water is represented by a static phereatic surface, the most conservative groundwater condition, as shown as GW-A on Plate 6.

The analyses consisted of first applying the gravity loads to establish the in-situ stresses for the existing slope topography. As expected, this analysis resulted in no noticeable deformation of the slope under existing gravity loads for the assumed soil properties and groundwater condition. The in-situ stresses established above were used as initial stresses within the slope before applying the seismic loads.

The design ground motions in terms of velocity time histories were, then, applied as input rock motion in the horizontal direction at the base of the model to simulate the dynamic shaking of the slope under seismic condition. Both the lower and upper level events were analyzed. For each event, two time histories consisting of an actual recorded and loosely spectra matched synthetic ground motion were used. The analyses of the slope for the lower and upper level events showed larger slope deformations when actual recorded time histories were used as input. As a result, we have only presented the results of the slope deformation analyses for the actual recorded motions used as input. Representative results of our deformation analysis are presented in Appendix C. A summary of the results is presented on Plate 21.

The results of the seismic deformation analyses in terms of computed absolute horizontal displacement time histories at three locations A, B and C on the top of the slope within the proposed development area (See Plate C-1 for location of these prints) for the lower level event and lower bound soil properties (c=2,000 psf and Ø =20°) indicate that the permanent slope deformations within the proposed development area are negligible (less than 1/4 inches) (See Plates C-3 through C-5). The corresponding computed absolute vertical displacements at the above locations were nil. Because for the other soil properties, the computed deformations are even less, we conclude that the subject slopes under the lower level event are stable. These conclusions are in agreement with those of the pseudo-static stability analyses of the slope using the limit equilibrium method (as described in the "Slope Stability Analysis" section of this report.

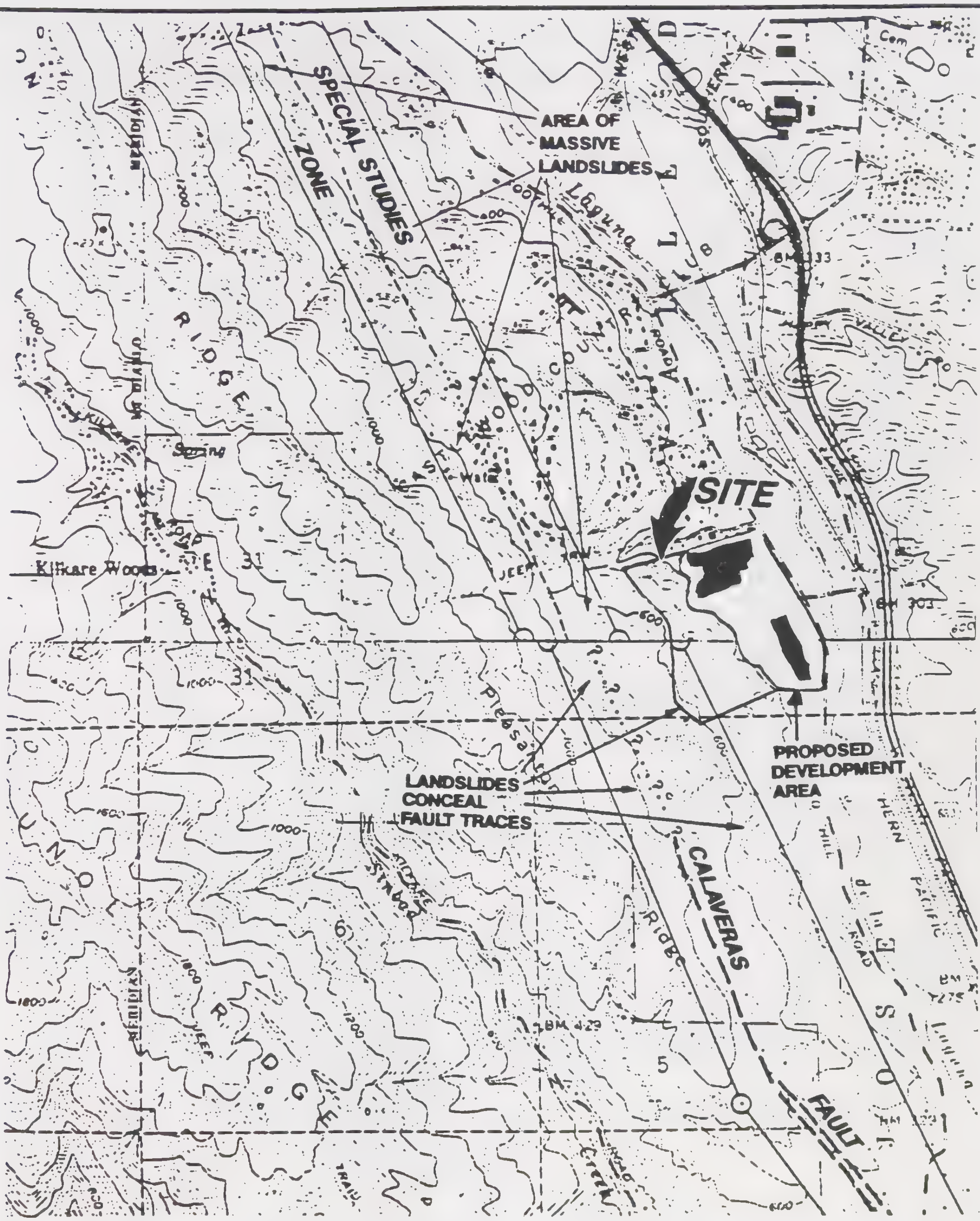
The computed absolute horizontal displacement time histories at the same three locations (A, B and C) within the proposed development area for the upper lower event and lower bound soil properties are presented on Plates C-7 through C-9 in Appendix C. The computed permanent horizontal displacements along the top of the slope within the proposed development area for the upper level event for all soil properties are presented on Plate 21. These results indicate that the estimated permanent displacements will range from about 4 to 11 inches at the upslope portion of the site to about 1/2 to 1 inch along the lower portion of the site. No significant permanent vertical displacements were calculated within the subject site under the upper level event.

As presented on Plate 21, the estimated amount of absolute displacement decreases rapidly towards the toe of the slope. For design purposes, the amount of movement considered should be in terms of differential movements to be tolerated by the planned structures or other improvements. From Plate 21, we estimate maximum differential movements up to about 2 inches within a horizontal distance of approximately 100 feet, which is the maximum length of the anticipated house structures. The proposed residences should be designed to withstand such movements.

XII. CONCLUSION

A comprehensive study has been performed by Kleinfelder to evaluate the static and dynamic stability of the existing ancient landslide underlying the proposed development site conditions. Our approach was to evaluate the slope stability for various possible soil strength parameters and groundwater conditions to evaluate the stability of the landslide, and its potential impact on the proposed development. We used current techniques including non-linear finite element deformation analysis to estimate the slope deformations during a lower and upper level seismic events, which may be expected at the proposed development site.

Based on the results of our static slope stability analyses, it appears that the ancient landslide posses a minimum static factor of safety equal to 1.5, which is considered to be the acceptable minimum by the industry, assuming zero cohesion and a friction value ranging between 20 to 22 degrees along the potential slide plane for all possible groundwater conditions analyzed for this project. When an estimated cohesion value of 300 psf is added to the soil strength, a minimum safety factor of 1.5 can be achieved with a friction angle value between 17.5 and 20 degrees. Based on the strength properties obtained by Terrasearch, and the information obtained from review of the recent literature, it appears that the in-situ strength properties of the slide plane should fall well within the above ranges. Hence, we conclude that the subject ancient slide underlying the proposed development area is stable under static condition for the groundwater scenarios that could occur at the site.



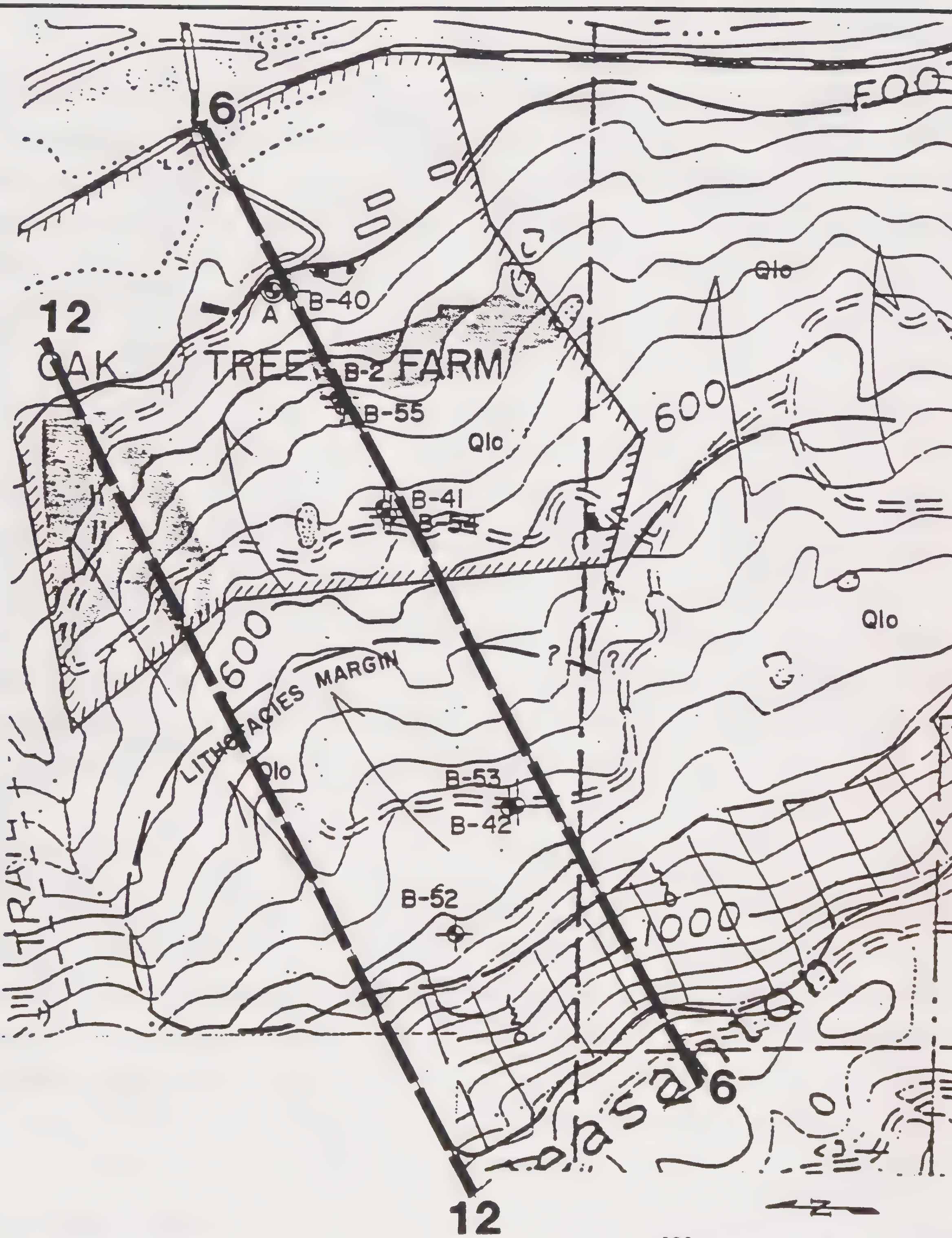
BASE: California Division of Mines and Geology

2000 0 2000
APPROXIMATE SCALE (feet)

KLEINFELDER

SITE VICINITY MAP OAK TREE FARM LANDSLIDE PLEASANTON, CALIFORNIA		PLATE 1
DRAFTED BY: L. Sue	DATE: 11-18-96	
CHECKED BY: C. Haynes	DATE: 11-18-96	PROJECT NO. 10-300464-001

CAD FILE:



600 0 600
APPROXIMATE SCALE (feet)

BASE: U.S.Geologic Survey

KLEINFELDER	CROSS-SECTION OAK TREE FARM LANDSLIDE PLEASANTON, CALIFORNIA		PLATE 2
DRAFTED BY: L. Sue	DATE: 11-18-96		
CHECKED BY: C. Haynes	DATE: 11-18-96	PROJECT NO. 10-300464-001	

CAD FILE:

LEGEND

- PROPERTY BOUNDARY (approximate location)
- PARCEL BOUNDARY
- (1) PARCEL NUMBER

200 0 200
APPROXIMATE SCALE (feet)

SOURCE:
Lynn Bowers and Associates Inc., "Vesting Tentative Map Tract No. 6898, Oakl Tree Farm Phase III, Pleasanton, California," dated 10-28-96.

KLEINFELDER	SITE PLAN OAK TREE FARM LANDSLIDE PLEASANTON, CALIFORNIA	PLATE 3
DRAFTED BY: L. Sue DATE: 11-18-96		
CHECKED BY: C. Haynes DATE: 11-25-96	PROJECT NO. 10-300464-001	

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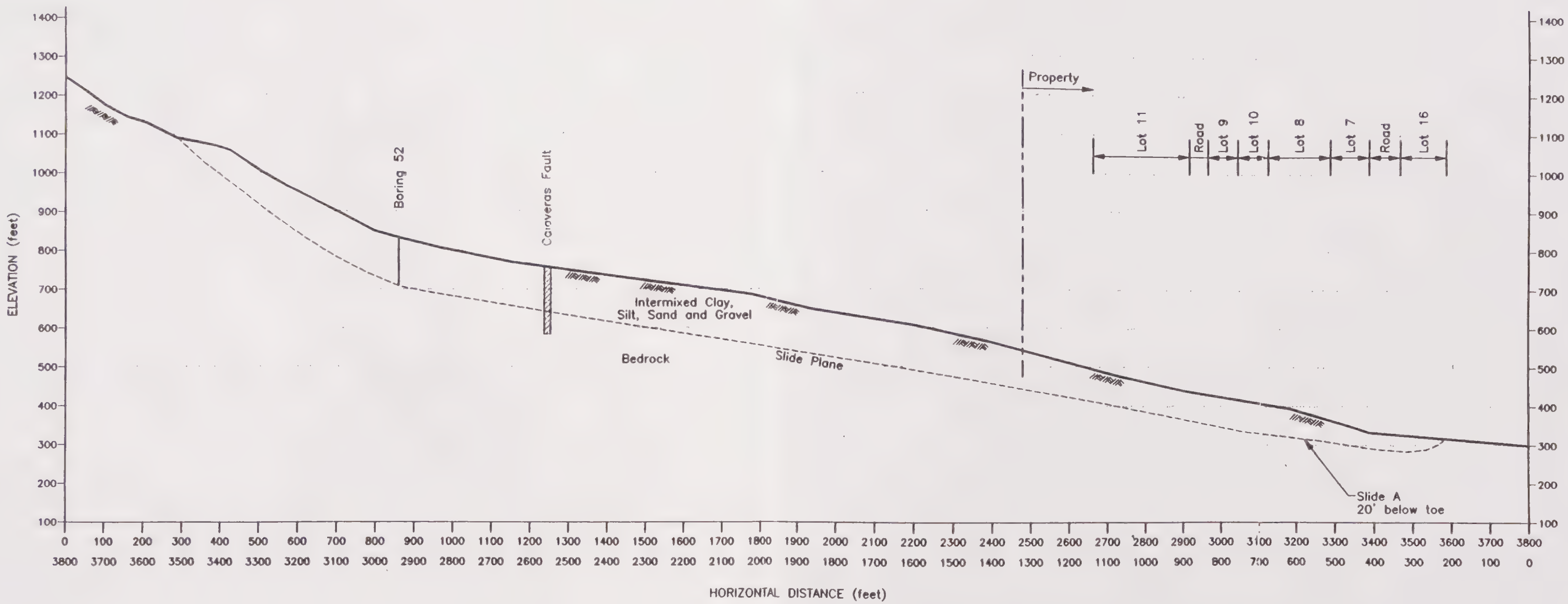
SECTION 12-12



NOTE:
Calaveras Fault is approximately located (Terrasearch, 1992)

KLEINFELDER

CROSS-SECTION 12-12	PLATE
OAK TREE FARM LANDSLIDE PLEASANTON, CALIFORNIA	4
PROJECT NO. 10-300464-001	

DRAFTED BY: L. Sue	DATE: 11-18-96
CHECKED BY: S. Ara	DATE: 11-25-96

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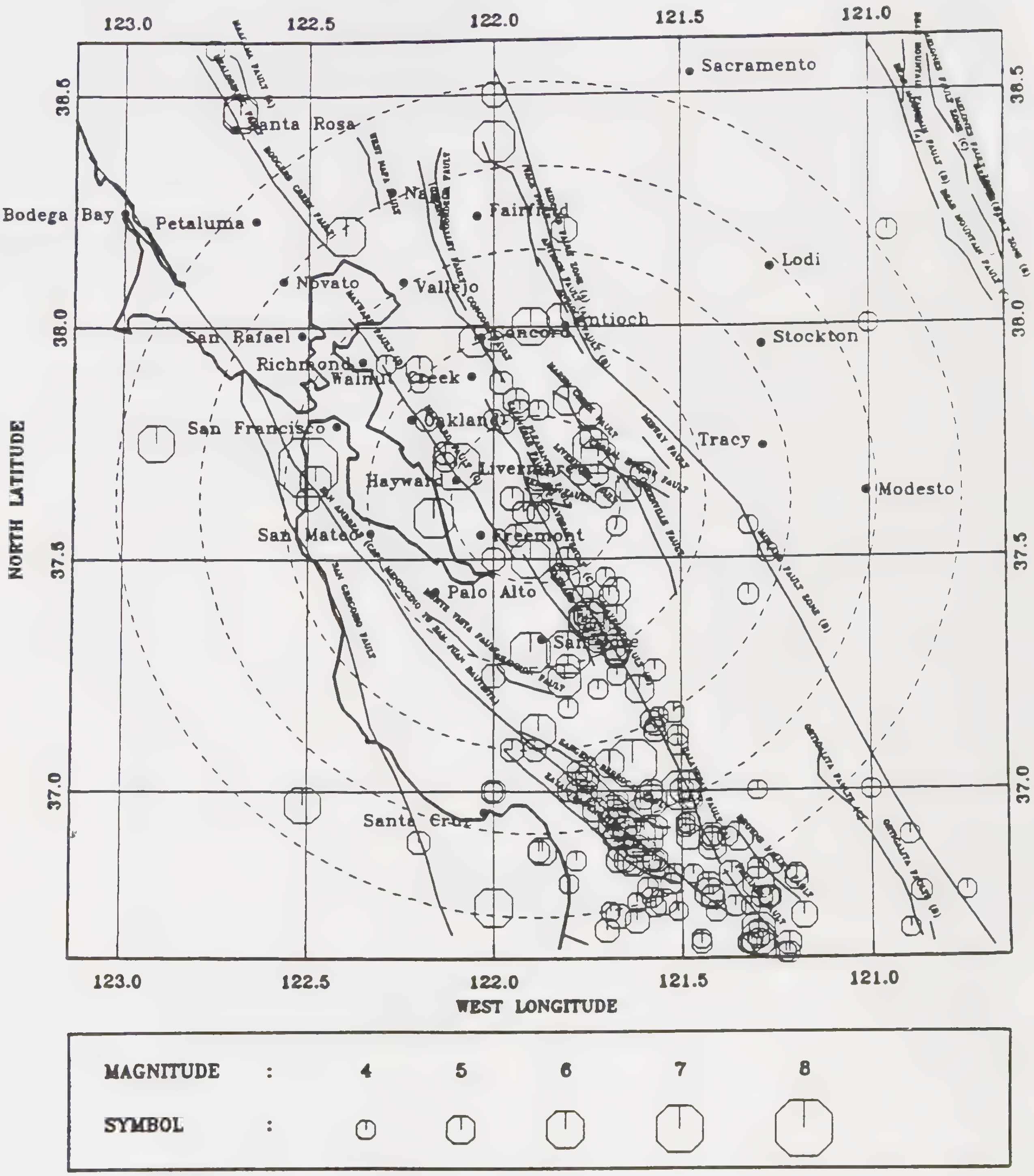
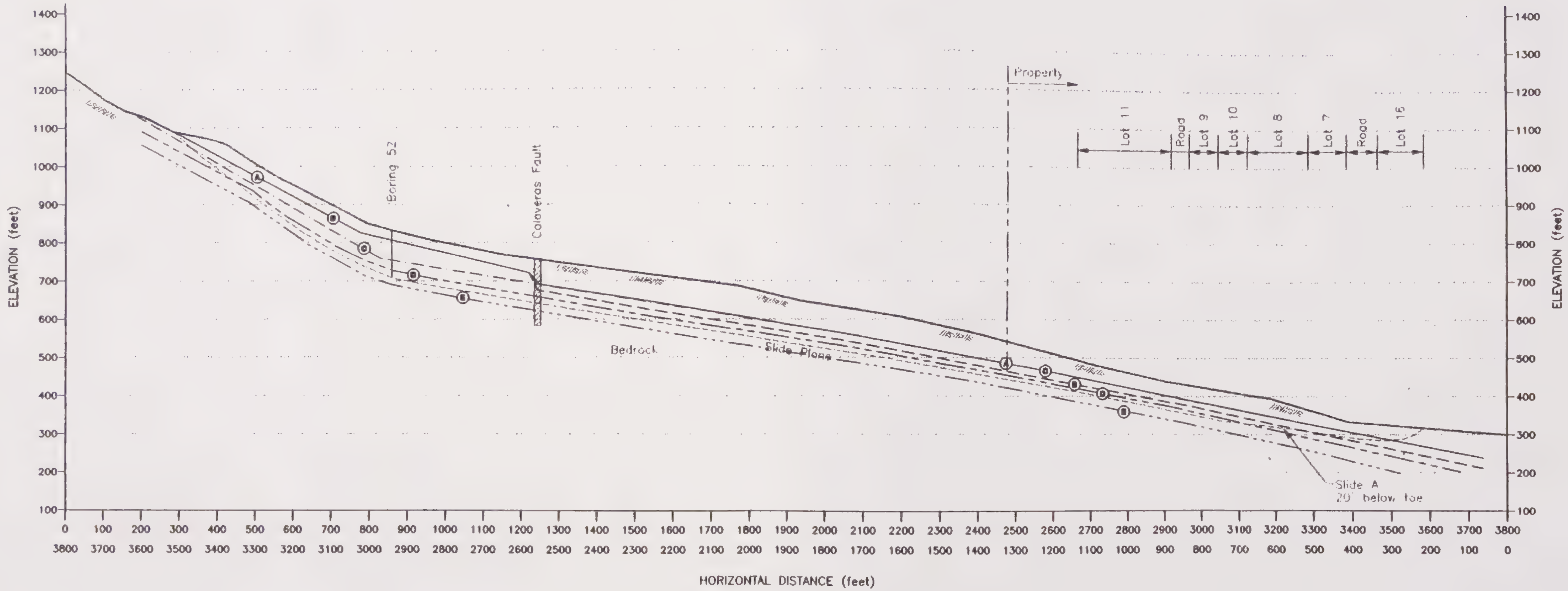


RADIUS OF LARGEST CIRCLE IS 100 KM

KLEINFELDER	FAULT MAP AND EPICENTERS OF EARTHQUAKES (1800–OCTOBER 1996)	PLATE
DRAFTED BY: Z. ZAFIR DATE: 11-21-96	OAK TREE FARM LANDSLIDE PLEASANTON, CALIFORNIA	5
CHECKED BY: S. ARA DATE: 11-22-96	PROJECT NUMBER 10-3004-64	

SECTION 12-12



- Ⓐ —— Groundwater at 30' above slide plane downslope of the fault and 30' below ground surface upslope of fault.
- Ⓑ – – – Groundwater at 20' above slide plane downslope of the fault and 30' below ground surface upslope of the fault.
- Ⓒ — — Groundwater at 30' above slide plane above and below fault.
- Ⓓ – · – Groundwater at 10' above slide plane above and below fault.
- Ⓔ – · · – No groundwater.

KLEINFELDER

DRAFTED BY: L. Sue DATE: 11-18-96

CHECKED BY: S. Ara DATE: 11-25-96

ESTIMATED GROUNDWATER LEVELS

OAK TREE FARM LANDSLIDE
PLEASANTON, CALIFORNIA

PROJECT NO. 10-300464-001

PLATE 6

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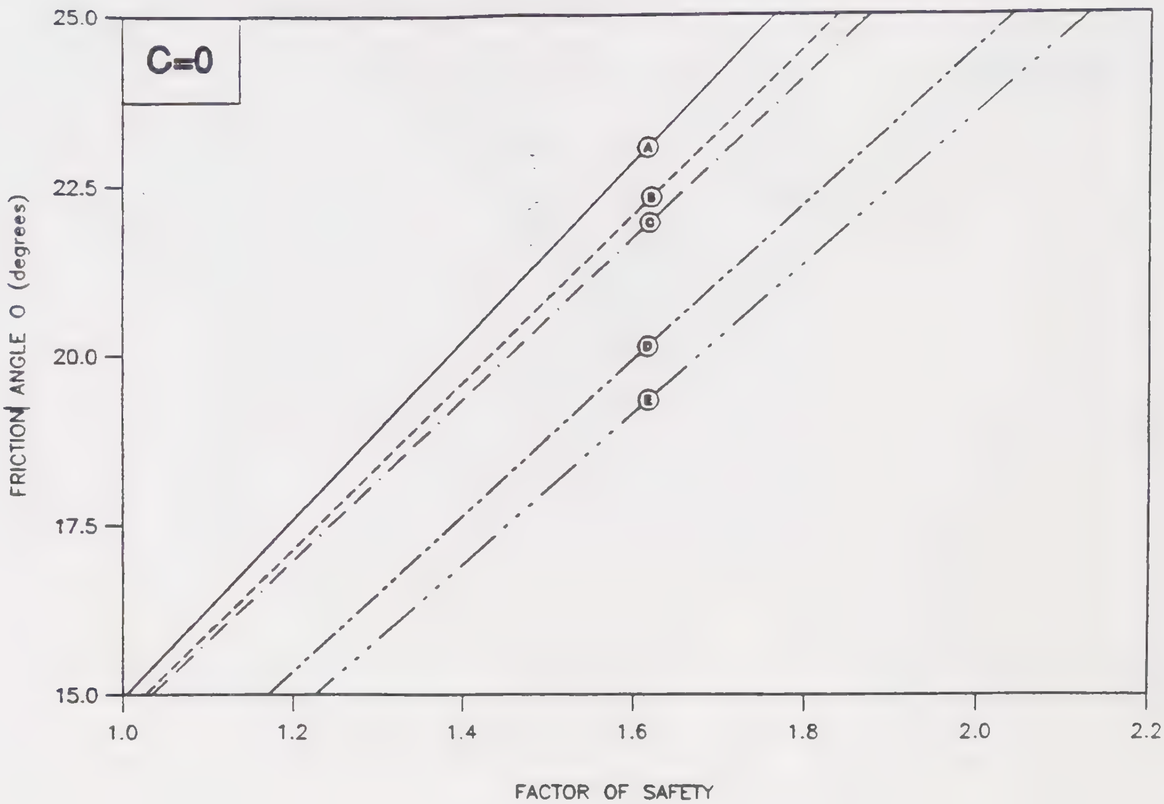

Ⓐ Groundwater at 30' above slide plane downslope of the fault and 30' below ground surface upslope of fault.

Ⓑ Groundwater at 20' above slide plane downslope of the fault and 30' below ground surface upslope of the fault.

Ⓒ Groundwater at 30' above slide plane above and below fault.

Ⓓ Groundwater at 10' above slide plane above and below fault.

Ⓔ No groundwater.

KLEINFELDER

STABILITY ANALYSIS (STATIC CONDITION)

OAK TREE FARM LANDSLIDE
PLEASANTON, CALIFORNIA

PLATE 7

DRAFTED BY: L. Sue	DATE: 11-19-96
CHECKED BY: S. Ara	DATE: 11-25-96

PROJECT NO. 10-300464-001

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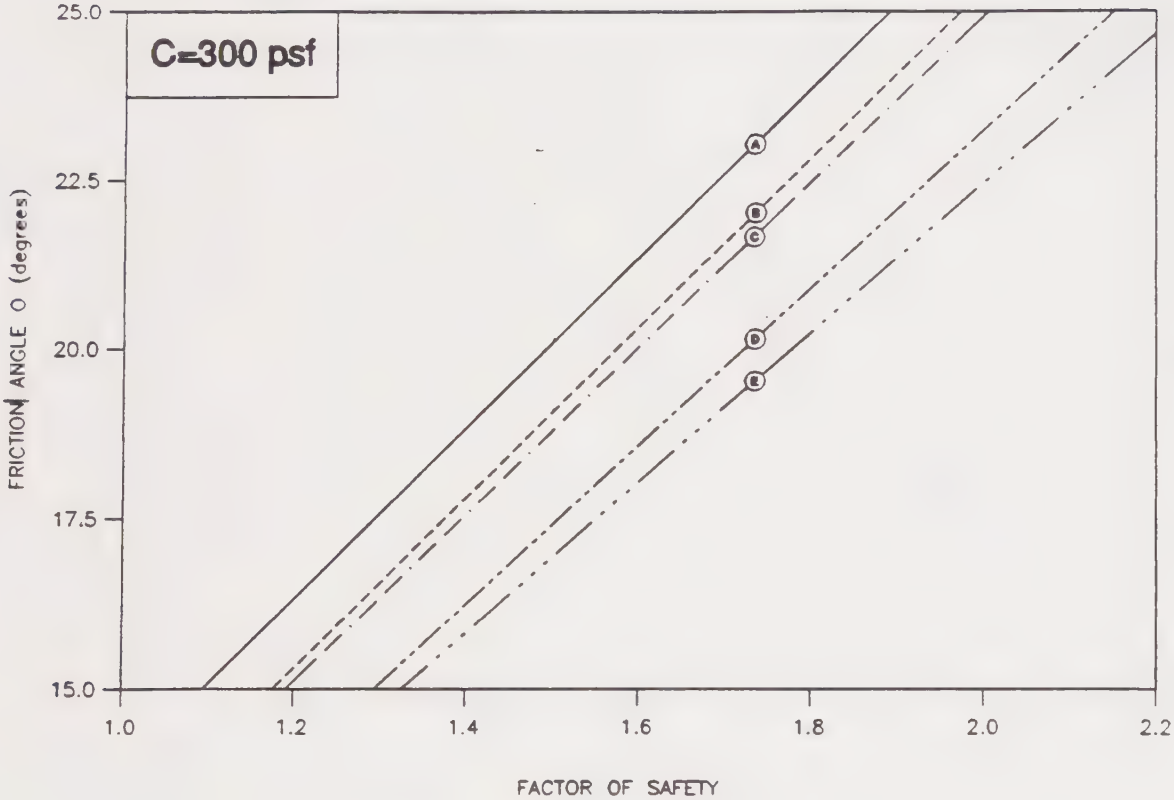

- (A) Groundwater at 30' above slide plane downslope of the fault and 30' below ground surface upslope of fault.
- (B) Groundwater at 20' above slide plane downslope of the fault and 30' below ground surface upslope of the fault.
- (C) Groundwater at 30' above slide plane above and below fault.
- (D) Groundwater at 10' above slide plane above and below fault.
- (E) No groundwater.

KLEINFELDER		STABILITY ANALYSIS (STATIC CONDITION) OAK TREE FARM LANDSLIDE PLEASANTON, CALIFORNIA	PLATE 8
DRAFTED BY: L. Sue	DATE: 11-19-96		
CHECKED BY: S. Ara	DATE: 11-25-96	PROJECT NO. 10-300464-001	

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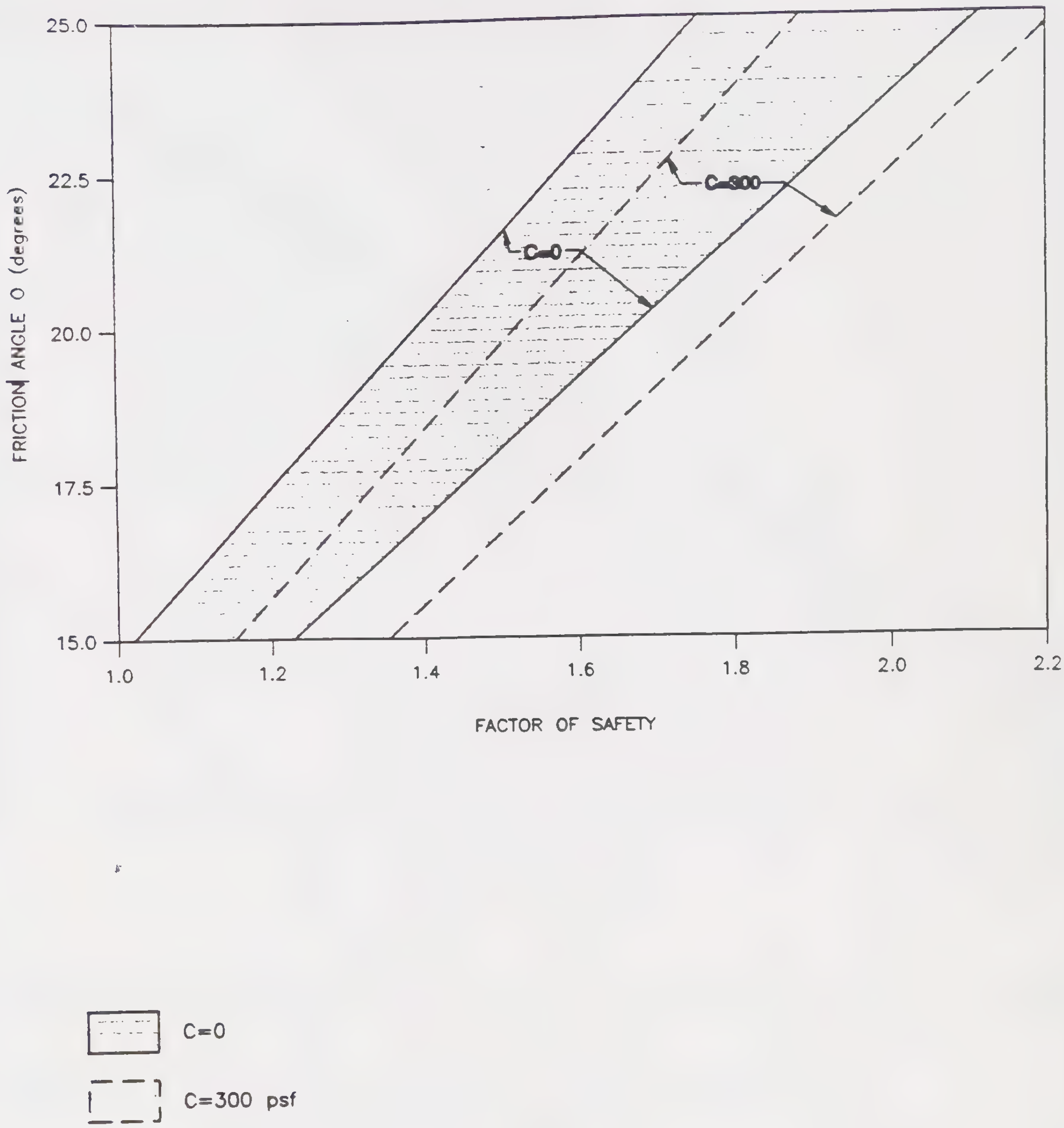

KLEINFELDER

DRAFTED BY: L. Sue	DATE: 11-19-96	STABILITY ANALYSIS (STATIC CONDITION) (COMBINED) OAK TREE FARM LANDSLIDE PLEASANTON, CALIFORNIA	PLATE 9
CHECKED BY: S. Ara	DATE: 11-25-96	PROJECT NO. 10-300464-001	

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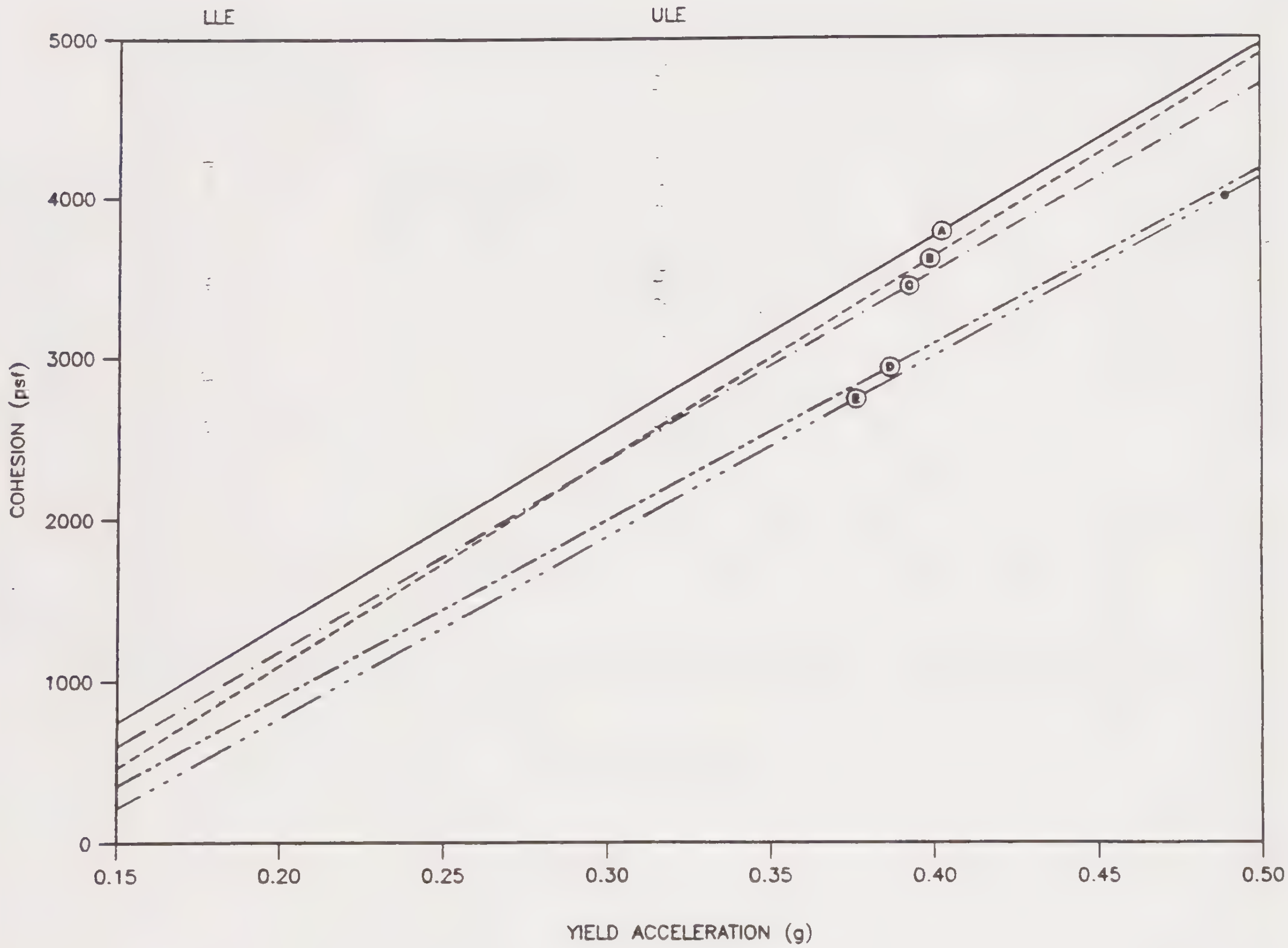
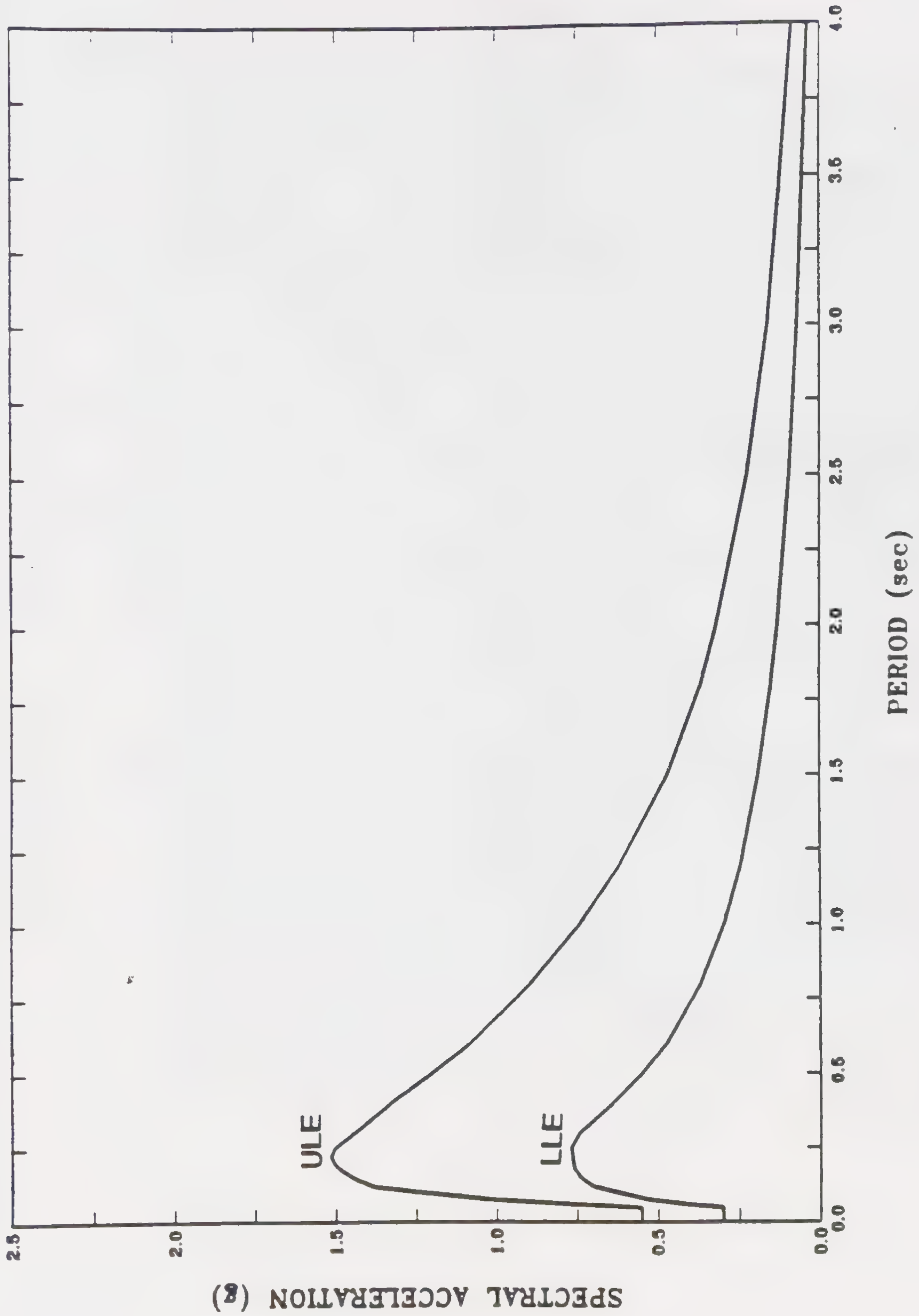


- (A) Groundwater at 30' above slide plane downslope of the fault and 30' below ground surface upslope of fault.
- (B) Groundwater at 20' above slide plane downslope of the fault and 30' below ground surface upslope of the fault.
- (C) Groundwater at 30' above slide plane above and below fault.
- (D) Groundwater at 10' above slide plane above and below fault.
- (E) No groundwater.

CAD FILE: C:_KA-PROJ\PLEAS\10300464\GRAPHS.dwg

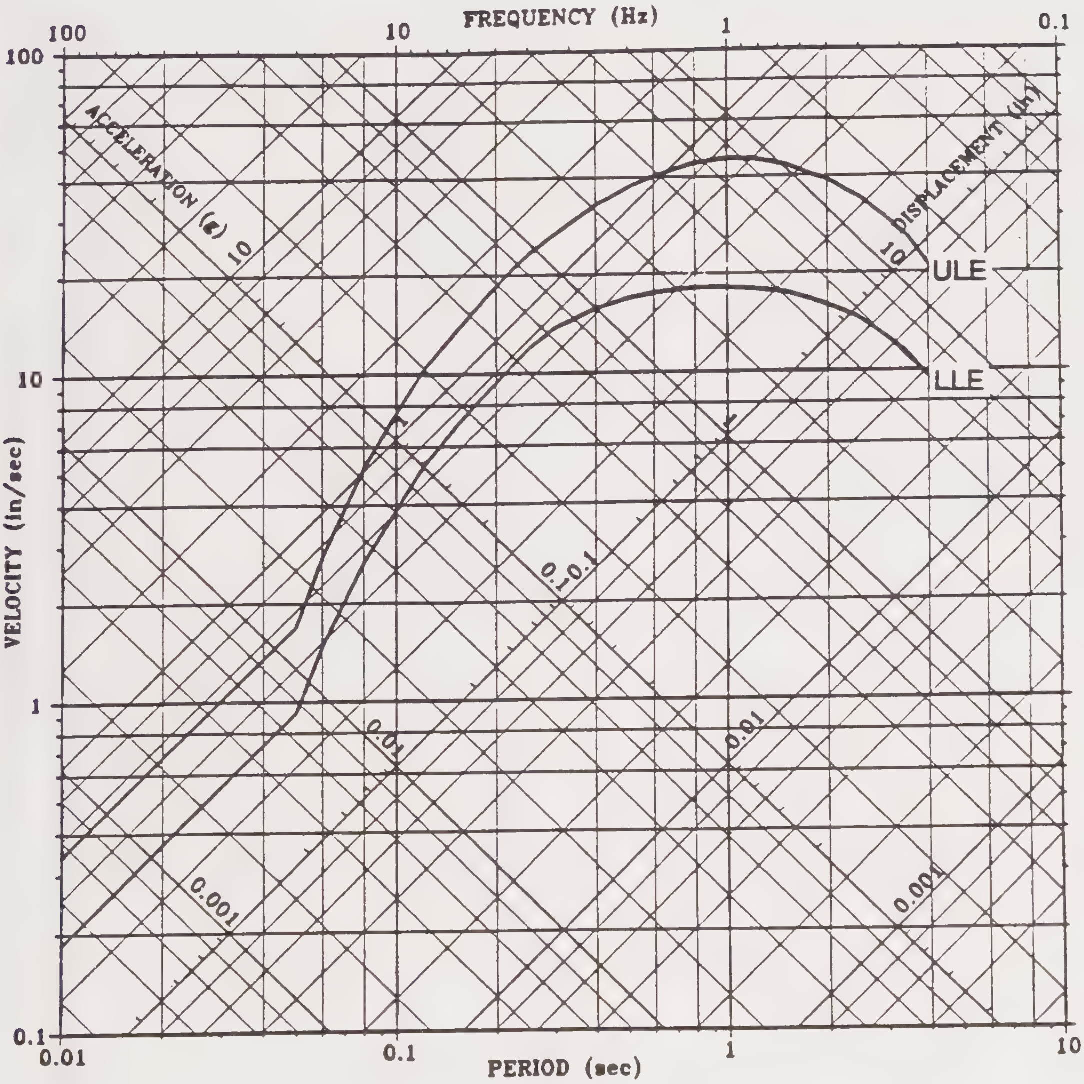
KLEINFELDER		STABILITY ANALYSIS (DYNAMIC CONDITION)	PLATE
		OAK TREE FARM LANDSLIDE PLEASANTON, CALIFORNIA	10
DRAFTED BY: L. Sue	DATE: 11-19-96		
CHECKED BY: S. Ara	DATE: 11-25-96	PROJECT NO. 10-300464-001	



LOWER LEVEL EVENT (LLE) = 50% PROBABILITY OF EXCEEDANCE IN 50 YEARS (PGA = 0.30g)

UPPER LEVEL EVENT (ULE) = 10% PROBABILITY OF EXCEEDANCE IN 50 YEARS (PGA = 0.55g)

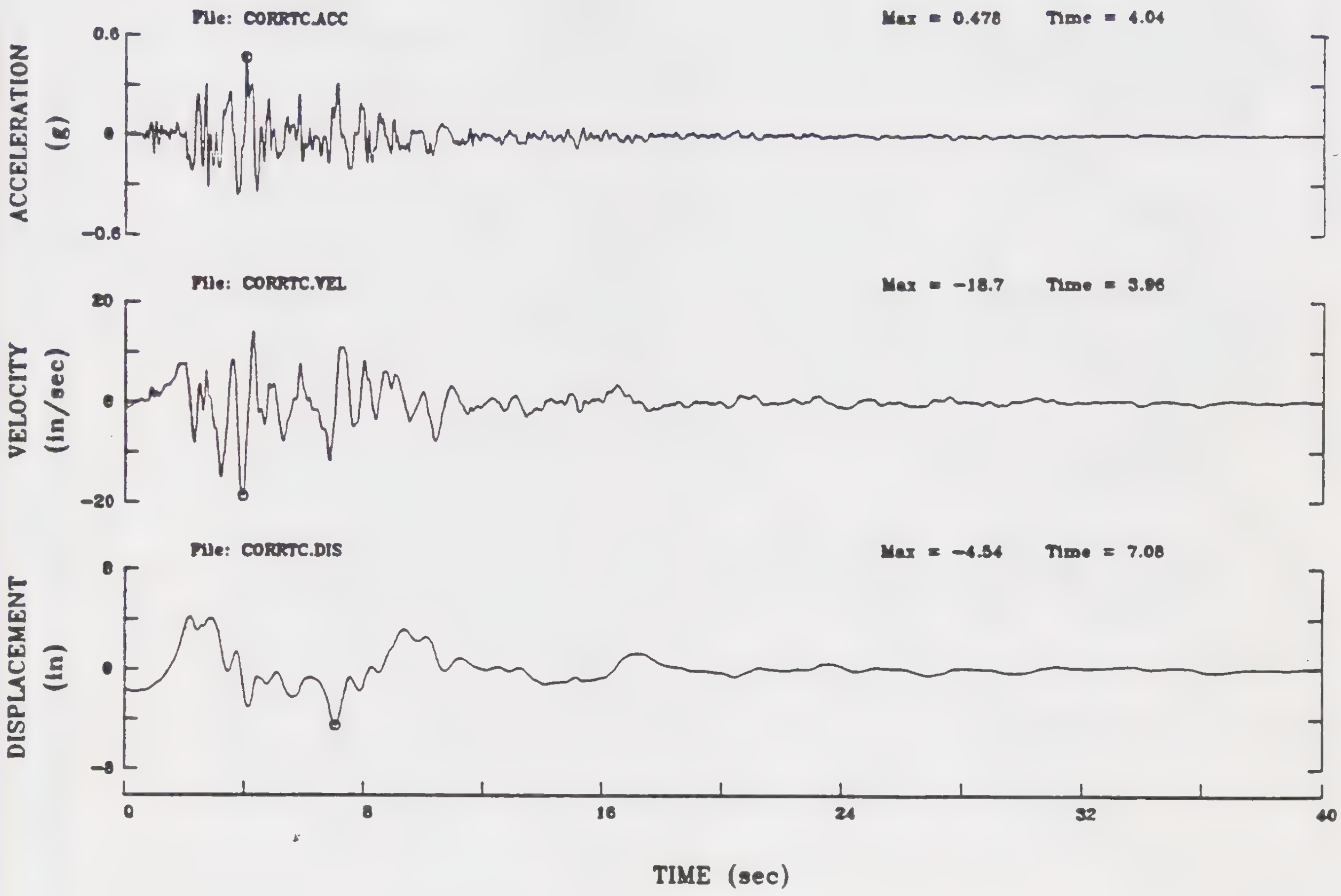
KLEINFELDER		SITE SPECIFIC RESPONSE SPECTRA 5% DAMPING OAK TREE FARM LANDSLIDE PLEASANTON, CALIFORNIA	PLATE 11
DRAFTED BY: Z. ZAFIR	DATE: 11-21-96		
CHECKED BY: S. ARA	DATE: 11-22-96	PROJECT NUMBER 10-3004-64	



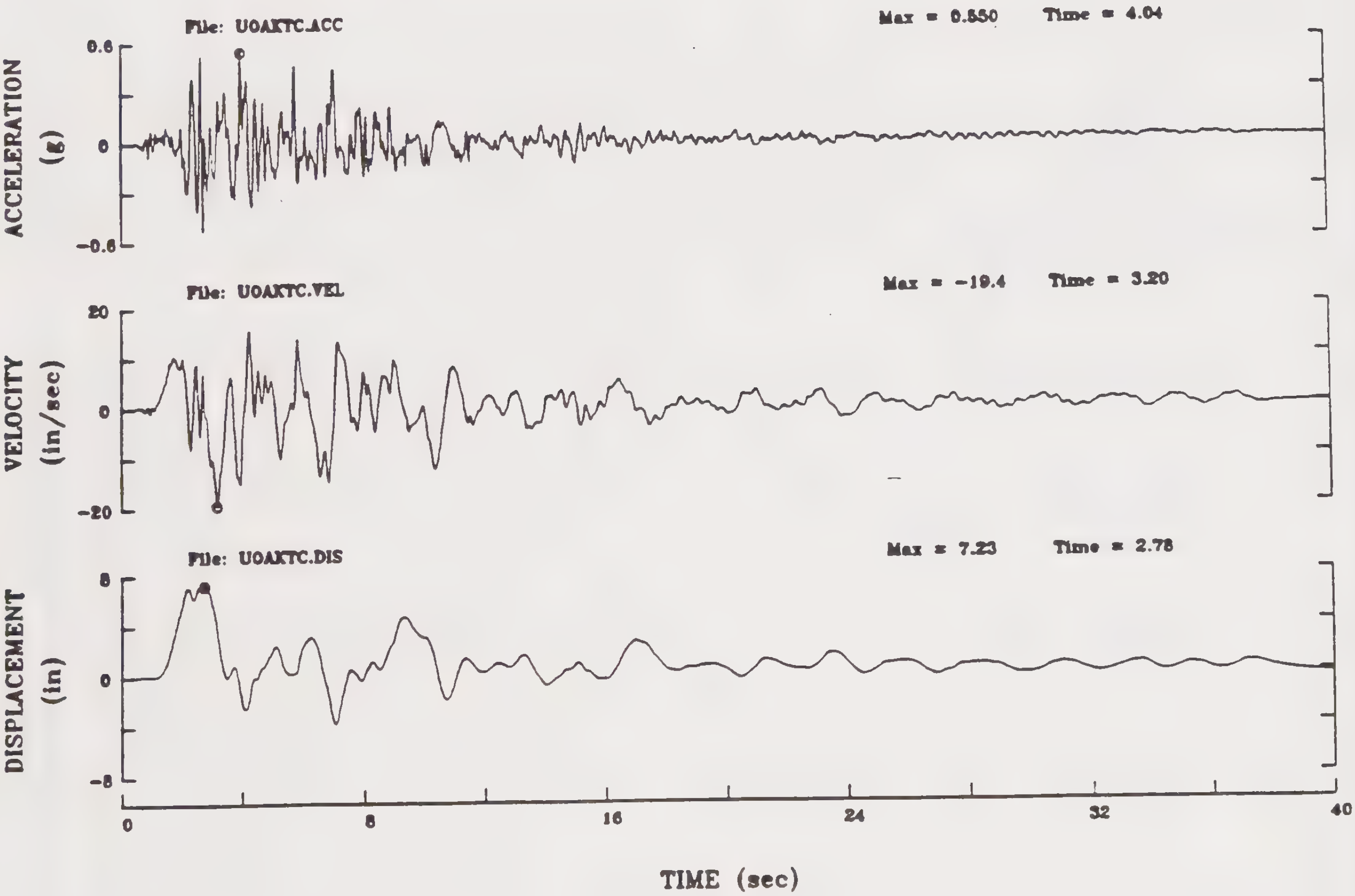
LOWER LEVEL EVENT (LLE) = 50% PROBABILITY OF EXCEEDANCE IN 50 YEARS (PGA = 0.30g)

UPPER LEVEL EVENT (ULE) = 10% PROBABILITY OF EXCEEDANCE IN 50 YEARS (PGA = 0.55g)

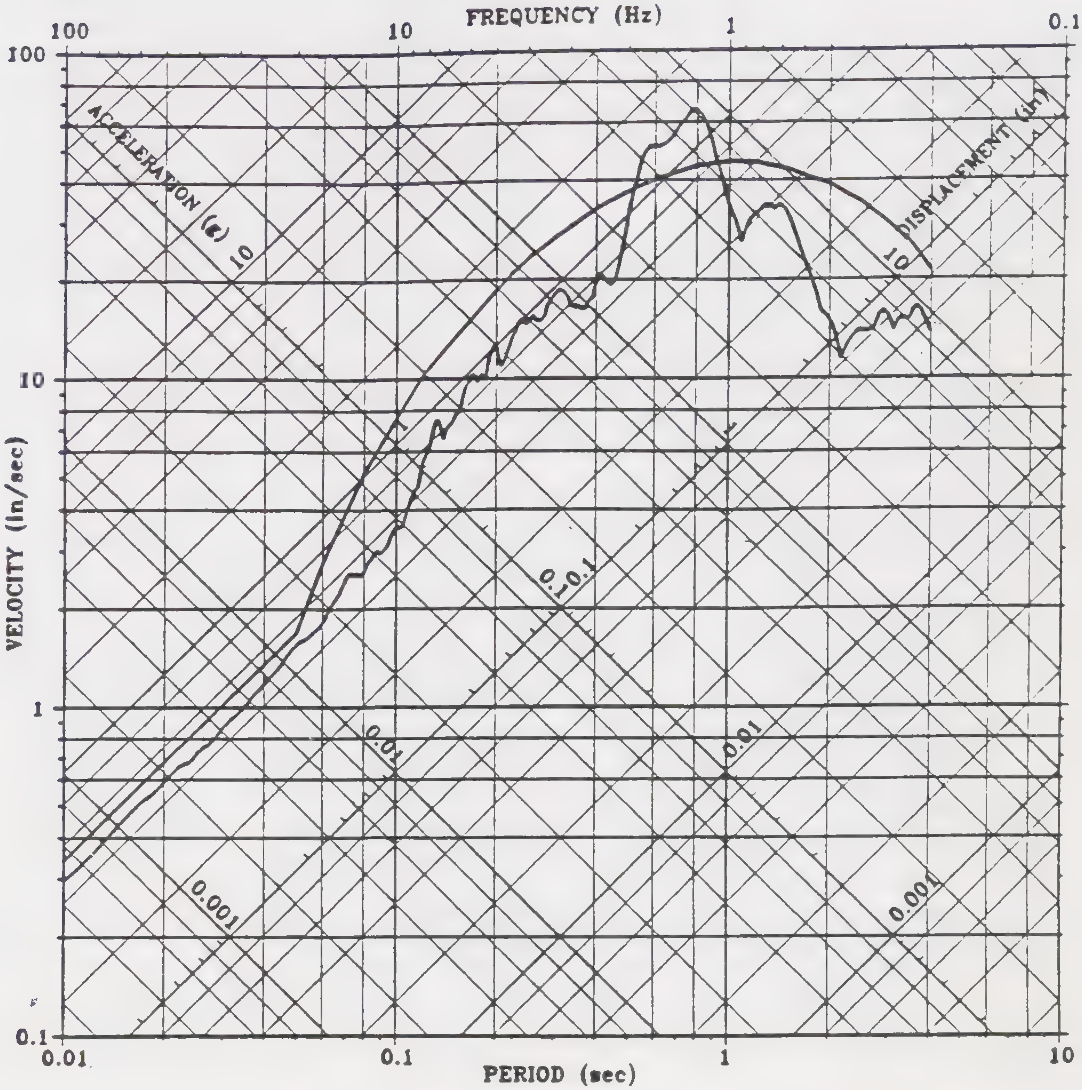
KLEINFELDER		SITE SPECIFIC RESPONSE SPECTRA 5% DAMPING OAK TREE FARM LANDSLIDE PLEASANTON, CALIFORNIA	PLATE 12
DRAFTED BY: Z. ZAFIR	DATE: 11-21-96		
CHECKED BY: S. ARA	DATE: 11-22-96	PROJECT NUMBER 10-3004-64	



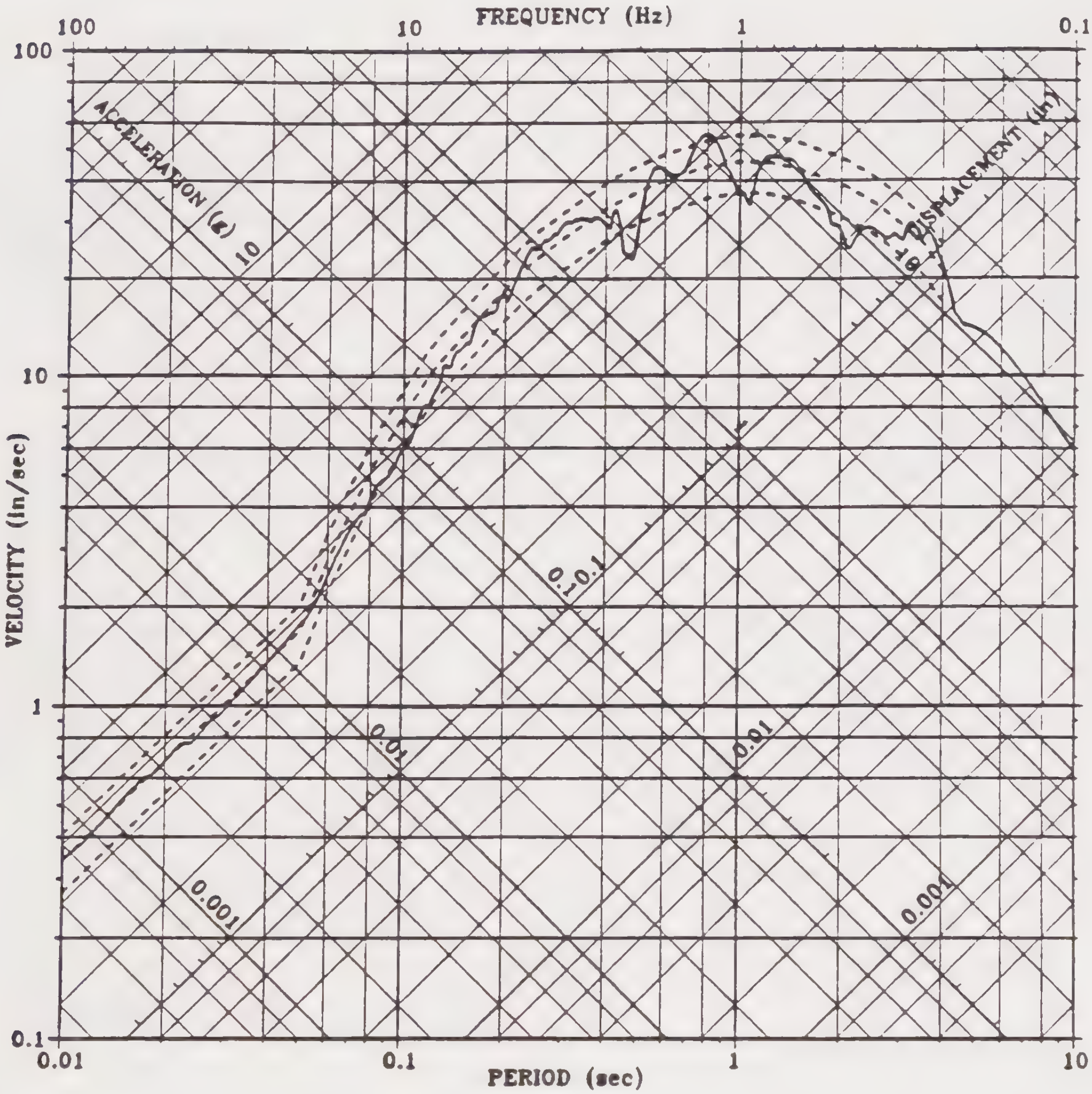
KLEINFELDER		CORRALITOS TIME HISTORY FROM LOMA PRIETA (M6.9) EARTHQUAKE - 90 DEGREE COMPONENT OAK TREE FARM LANDSLIDE PLEASANTON, CALIFORNIA	PLATE 13
DRAFTED BY: Z. ZAFIR	DATE: 11-21-96		
CHECKED BY: S. ARA	DATE: 11-22-96	PROJECT NUMBER 10-3004-64	



KLEINFELDER		SPECTRA MATCHED TIME HISTORY (ULE) OAK TREE FARM LANDSLIDE PLEASANTON, CALIFORNIA	PLATE 14
DRAFTED BY: Z. ZAFIR	DATE: 11-21-96		
CHECKED BY: S. ARA	DATE: 11-22-96	PROJECT NUMBER 10-3004-64	



KLEINFELDER		SPECTRA OF CORRALITOS TIME HISTORY - 90 DEGREE COMPONENT - 5% DAMPING	PLATE
DRAFTED BY: Z. ZAFIR	DATE: 11-21-96	OAK TREE FARM LANDSLIDE PLEASANTON, CALIFORNIA	15
CHECKED BY: S. ARA	DATE: 11-22-96	PROJECT NUMBER 10-3004-64	



KLEINFELDER

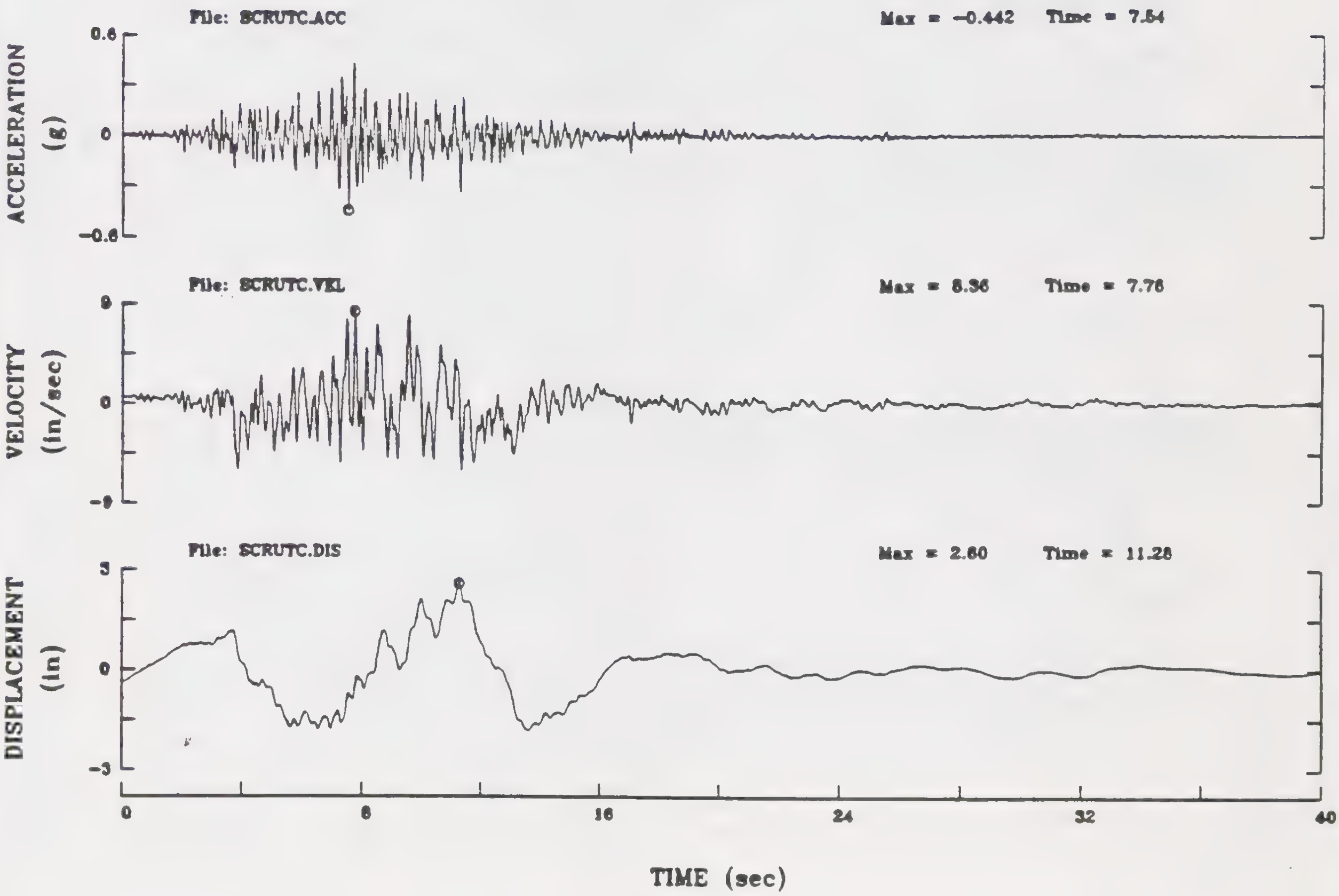
SPECTRA FOR MATCHING TIME HISTORY (ULE) - 5% DAMPING

OAK TREE FARM LANDSLIDE
PLEASANTON, CALIFORNIA

PLATE 16

DRAFTED BY:	Z. ZAFIR	DATE:	11-21-96
CHECKED BY:	S. ARA	DATE:	11-22-96

PROJECT NUMBER 10-3004-64



KLEINFELDER

DRAFTED BY: Z. ZAFIR	DATE: 11-21-96	
CHECKED BY: S. ARA	DATE: 11-22-96	

UC SANTA CRUZ TIME HISTORY FROM LOMA PRIETA (M6.9) EARTHQUAKE - 90 DEGREE COMPONENT

OAK TREE FARM LANDSLIDE
PLEASANTON, CALIFORNIA

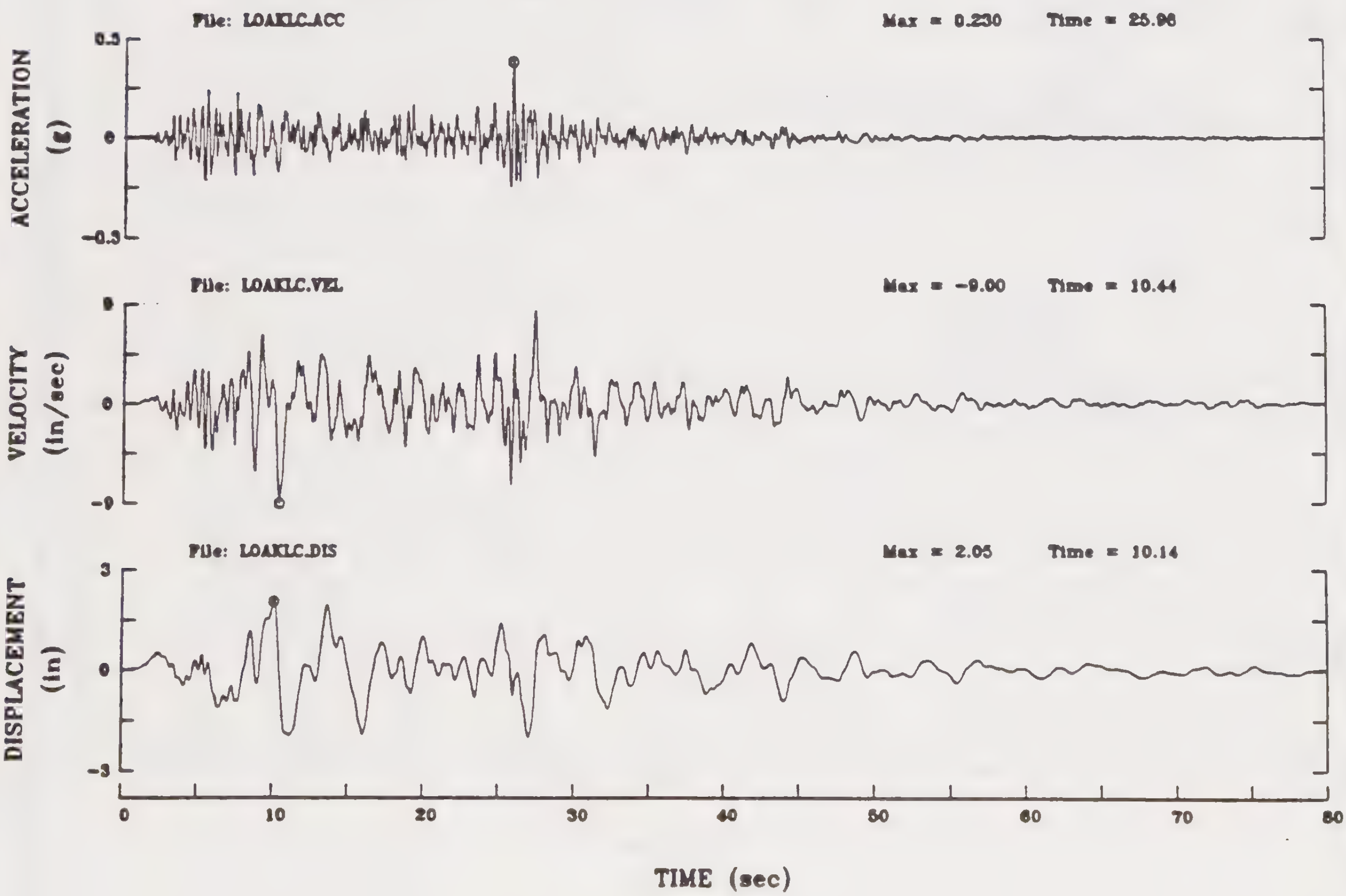
PROJECT NUMBER 10-3004-64

PLATE

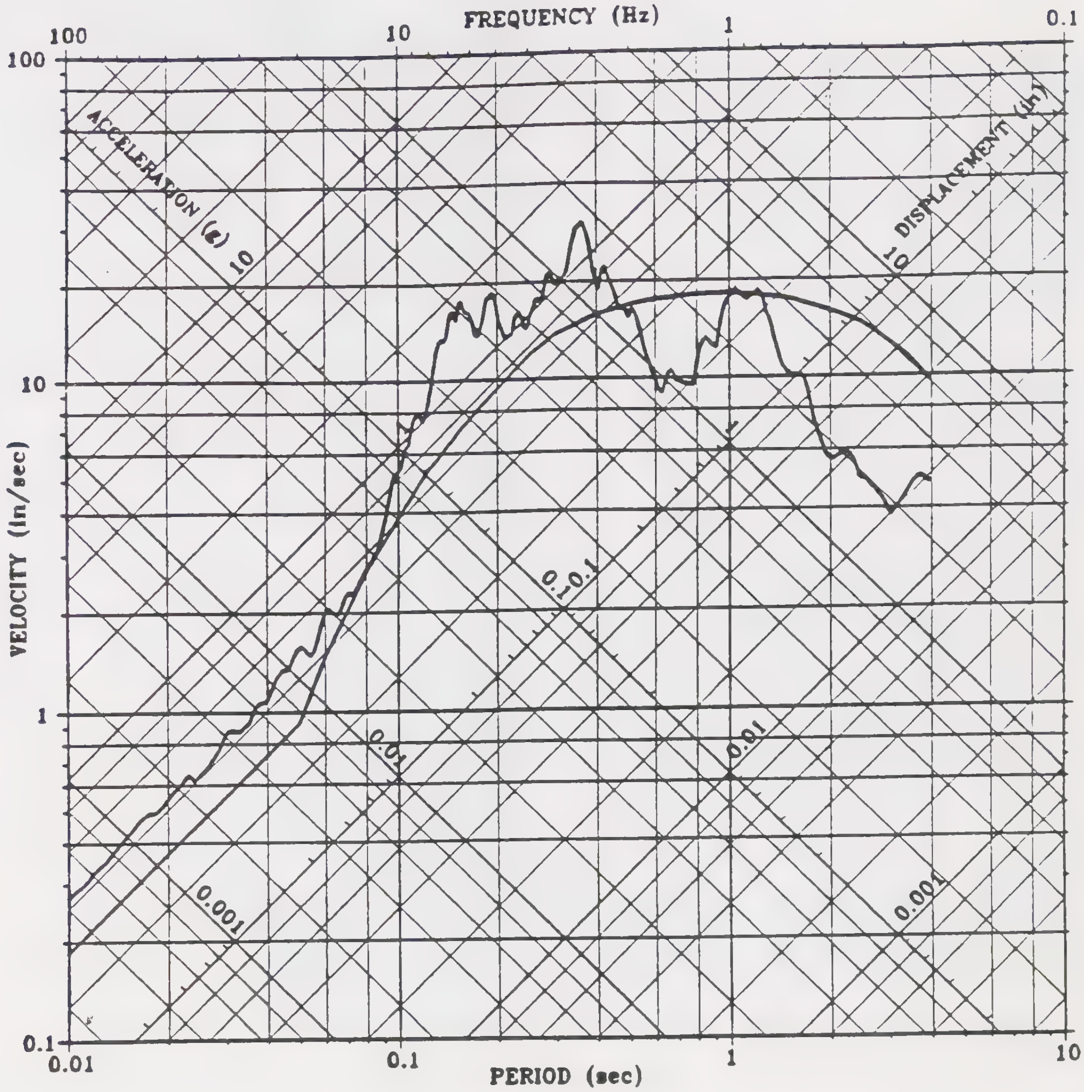
17

OAK TREE FARM LANDSLIDE, PLEASANTON, CA

SPECTRA MATCHED TIME HISTORY, LLE (BL CORR)(LONGITUDINAL)



KLEINFELDER		JOSHUA TREE FIRESTATION TIME HISTORY OF LANDERS (M7.5) EARTHQUAKE - 0 DEG COMPONENT OAK TREE FARM LANDSLIDE PLEASANTON, CALIFORNIA	PLATE 18
DRAFTED BY: Z. ZAFIR	DATE: 11-21-96		
CHECKED BY: S. ARA	DATE: 11-22-96	PROJECT NUMBER 10-3004-64	



KLEINFELDER

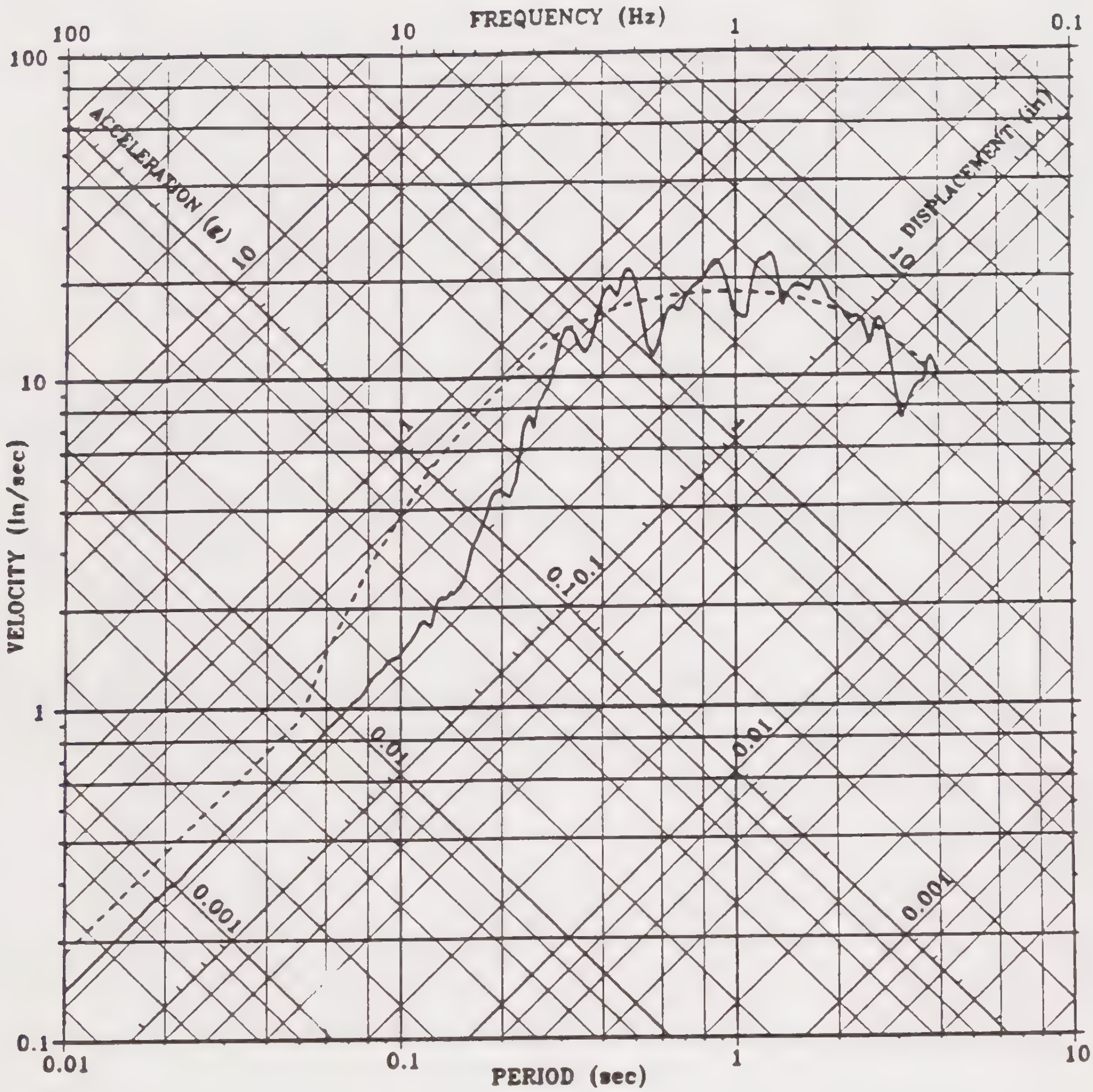
SPECTRA OF UC SANTA CRUZ TIME HISTORY - 90 DEGREE COMPONENT - 5% DAMPING

OAK TREE FARM LANDSLIDE
PLEASANTON, CALIFORNIA

PLATE **19**

DRAFTED BY:	Z. ZAFIR	DATE:	11-21-96
CHECKED BY:	S. ARA	DATE:	11-22-96

PROJECT NUMBER 10-3004-64



KLEINFELDER

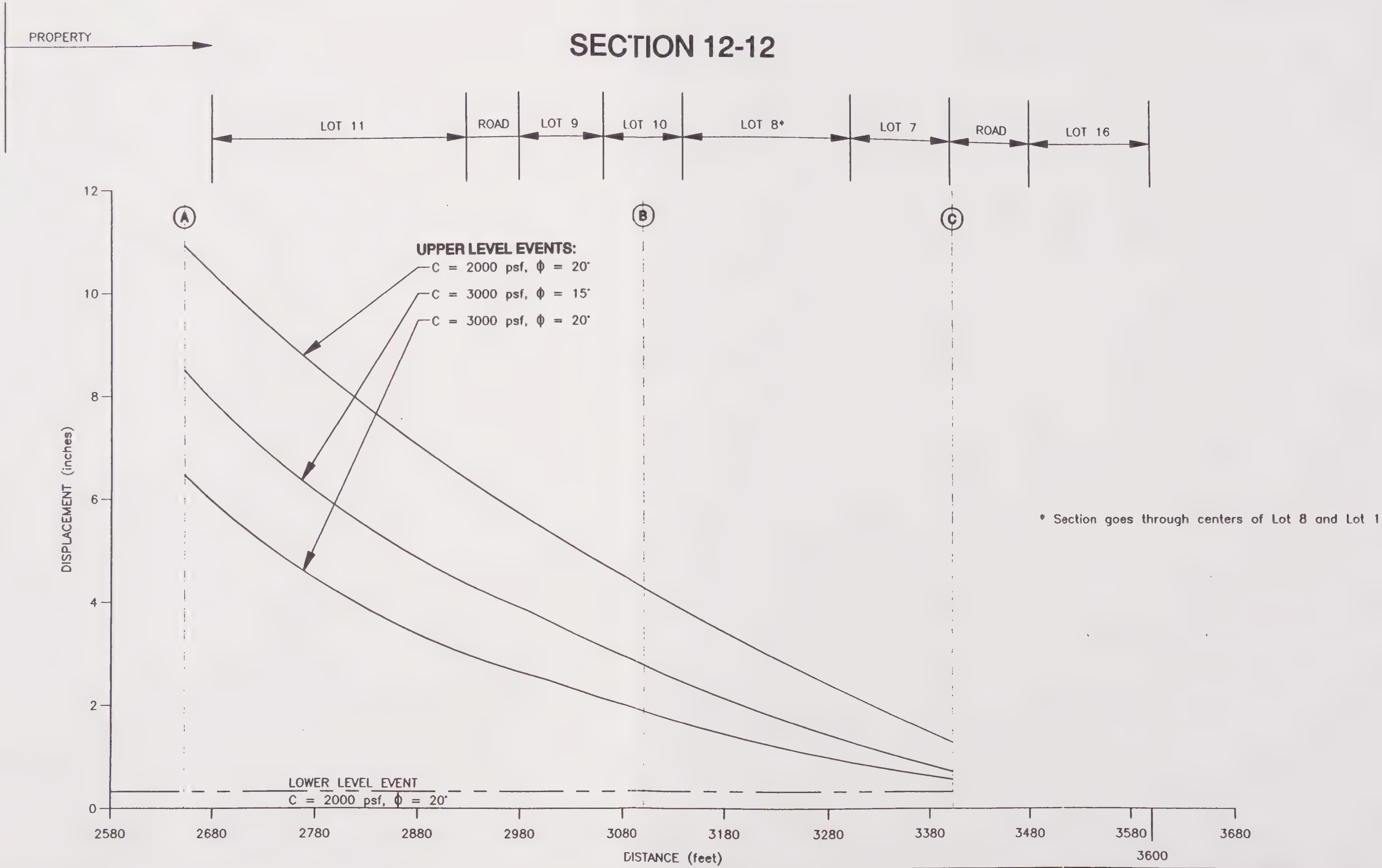
SPECTRA OF JOSHUA TREE FIRESTATION TIME HISTORY - 0 DEG COMPONENT - 5% DAMPING

OAK TREE FARM LANDSLIDE
PLEASANTON, CALIFORNIA

PLATE 20

DRAFTED BY:	Z. ZAFIR	DATE:	11-21-96
CHECKED BY:	S. ARA	DATE:	11-22-96

PROJECT NUMBER 10-3004-64



KLEINFELDER

COMPUTED HORIZONTAL DISPLACEMENT

PLATE 21

DRAFTED BY: L. Sue — DATE: 11-22-96

CHECKED BY: S. Ara — DATE: 11-25-96

OAK TREE FARM LANDSLIDE
PLEASANTON, CALIFORNIA

PROJECT NO. 10-300464-001

CAD FILE: C:_KA-PROJ\PLEAS\10300464\XSECTION2

APPENDIX A

APPENDIX A

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APPENDIX B

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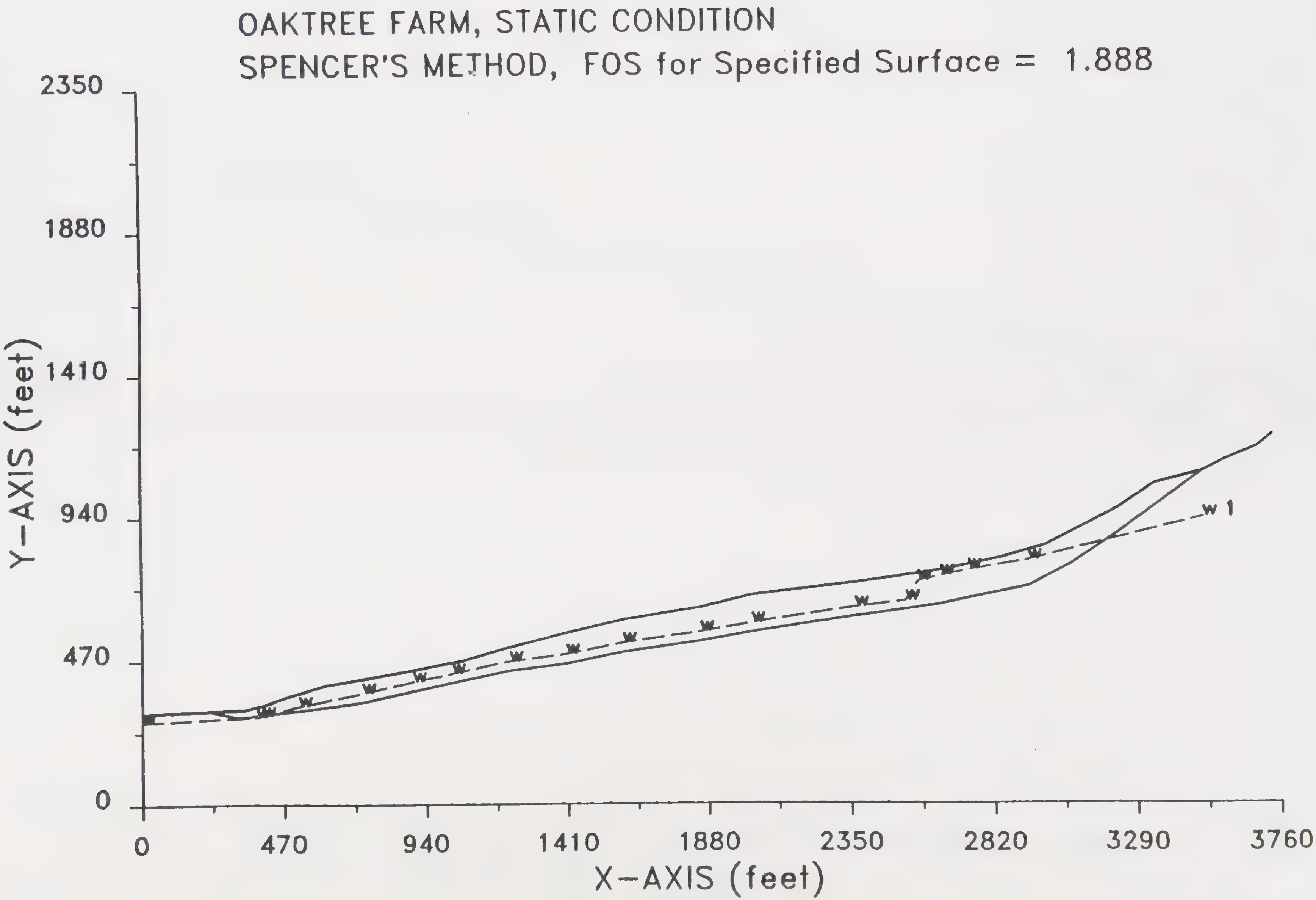

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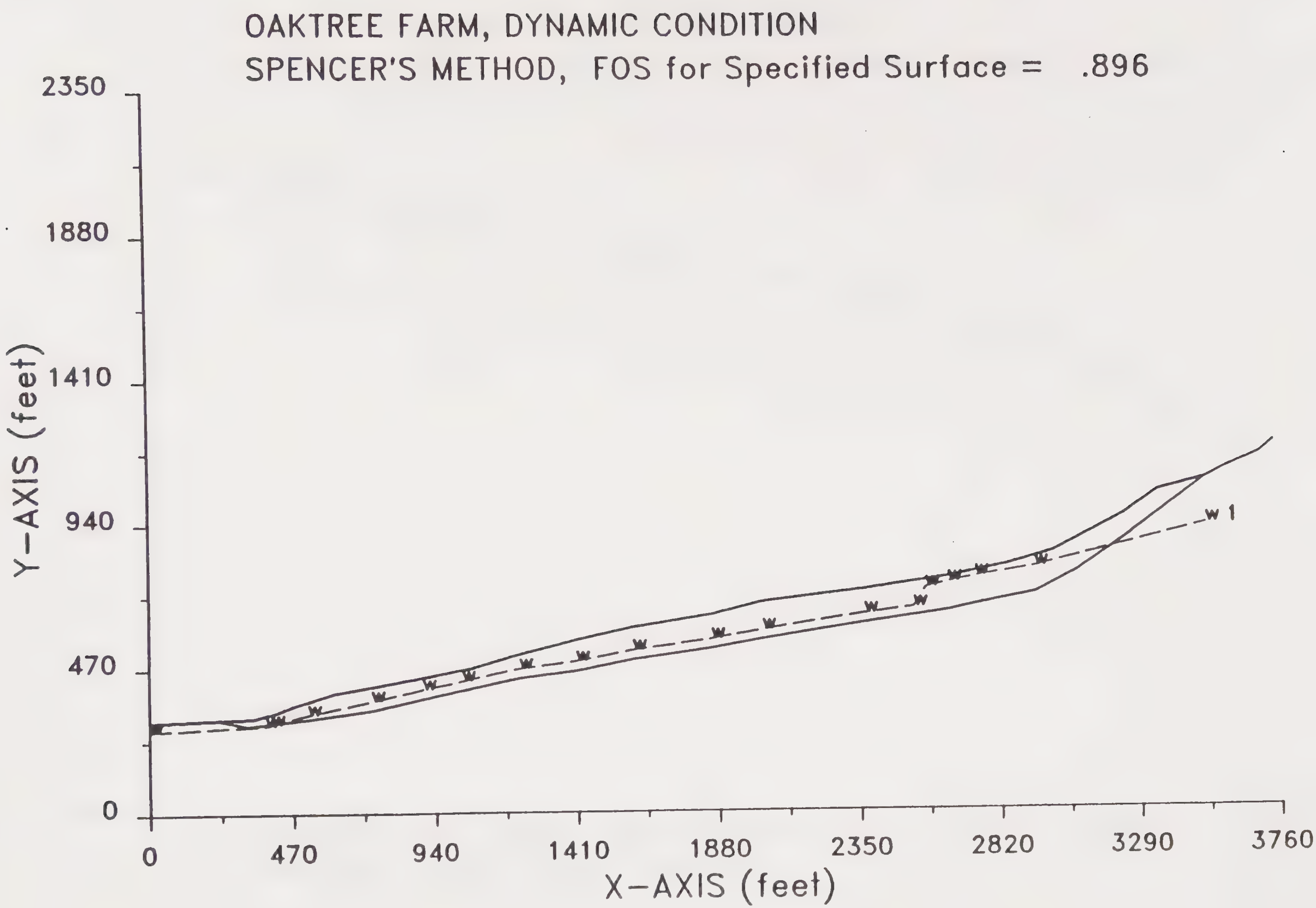

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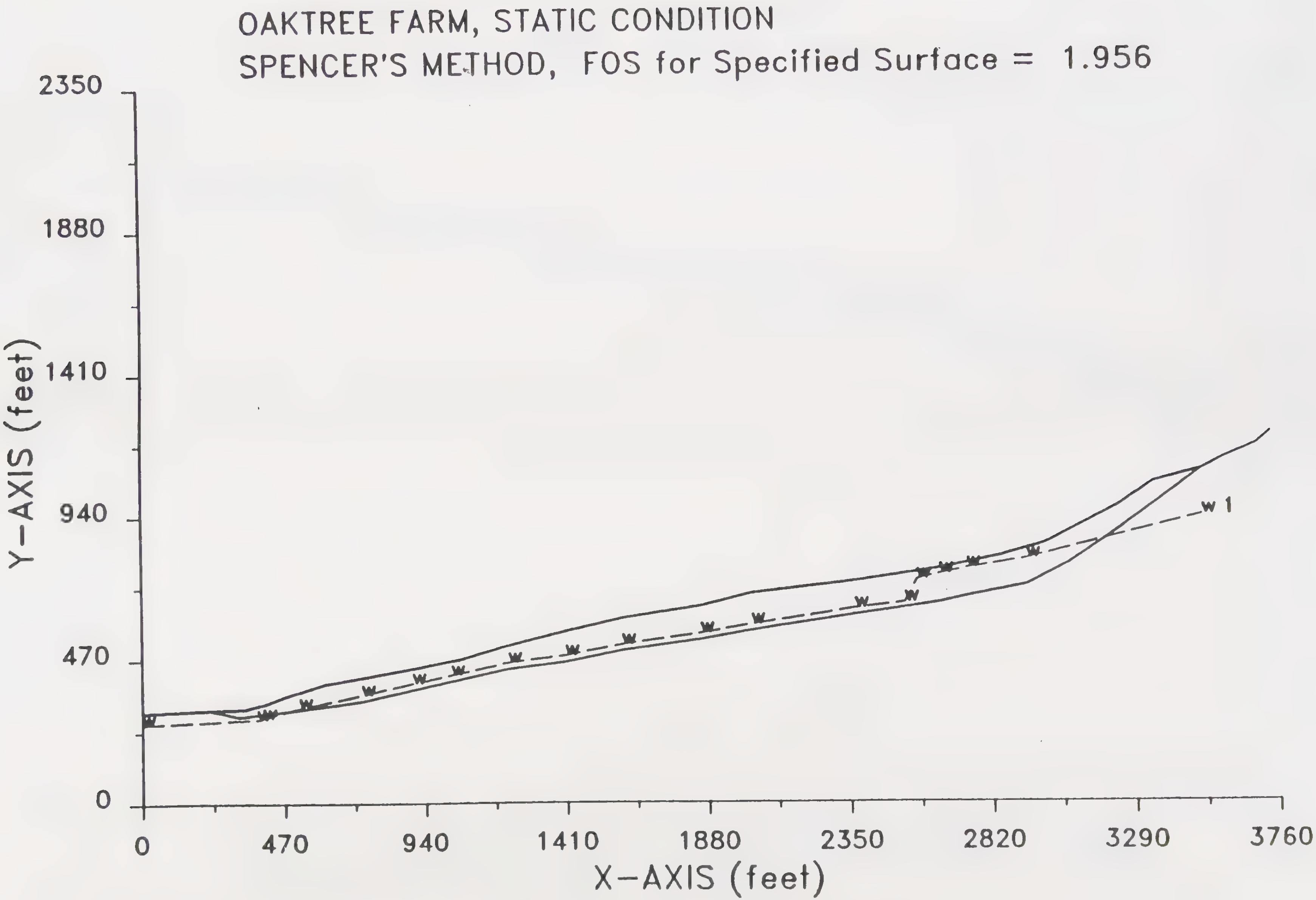

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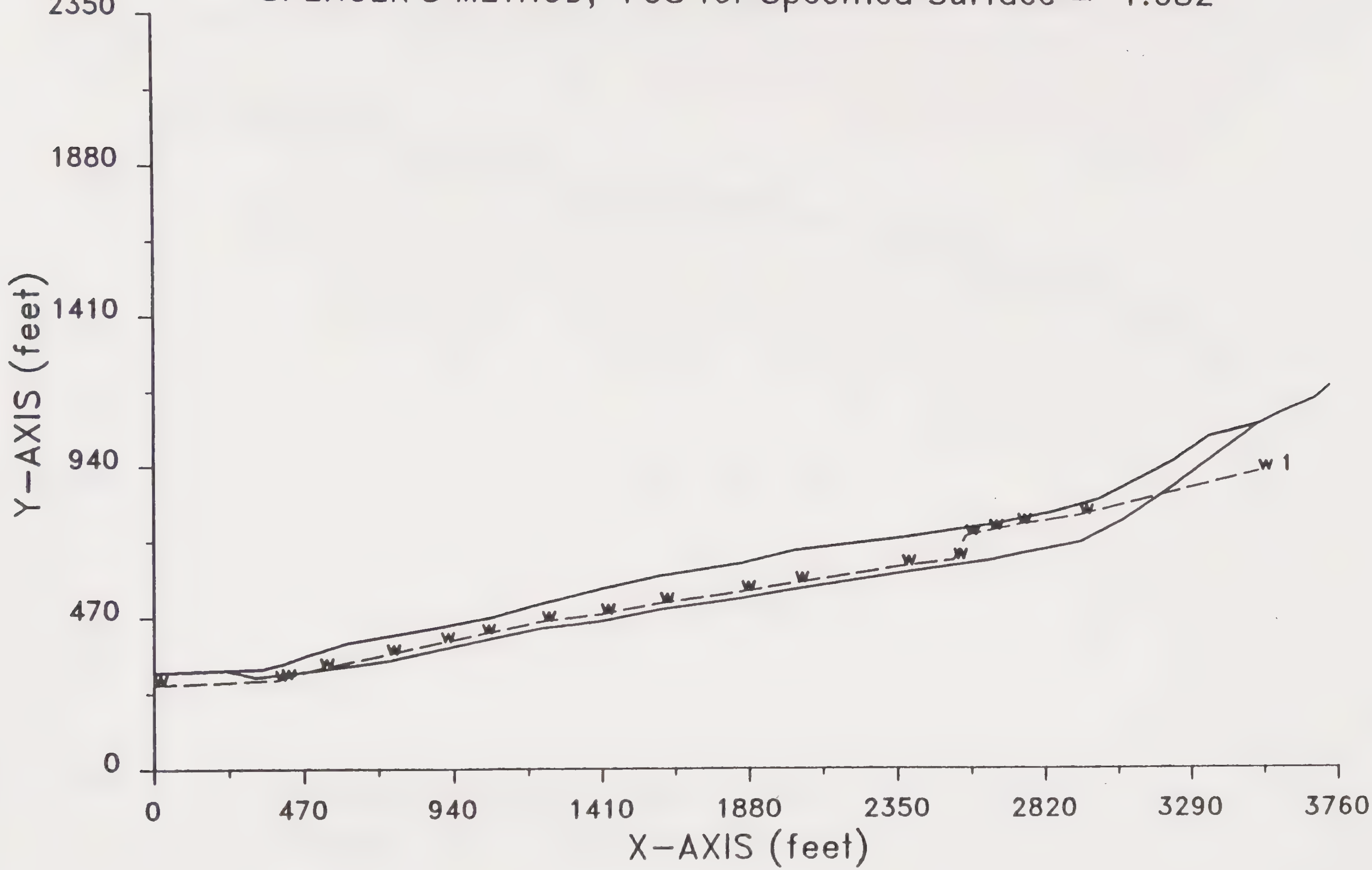
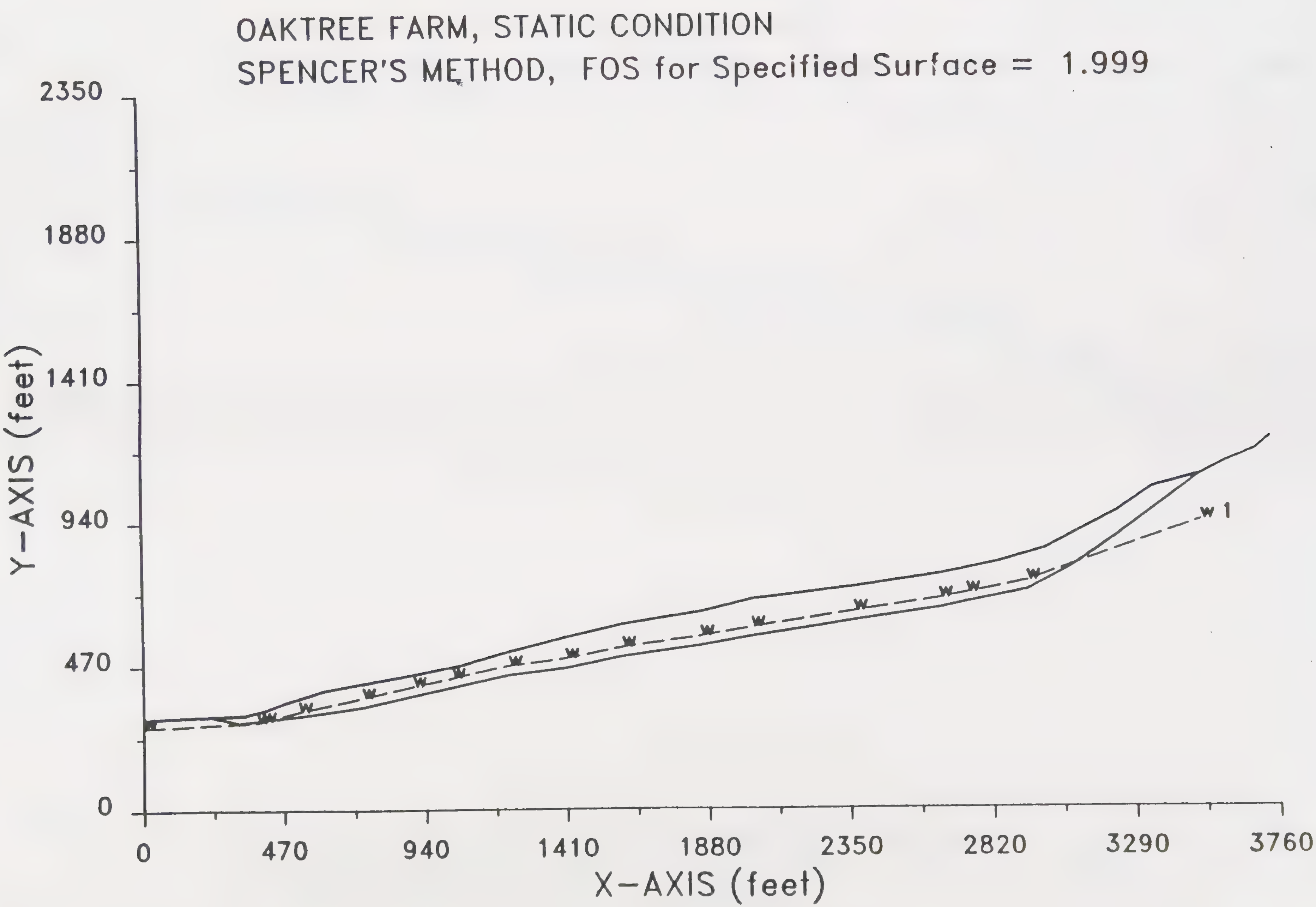
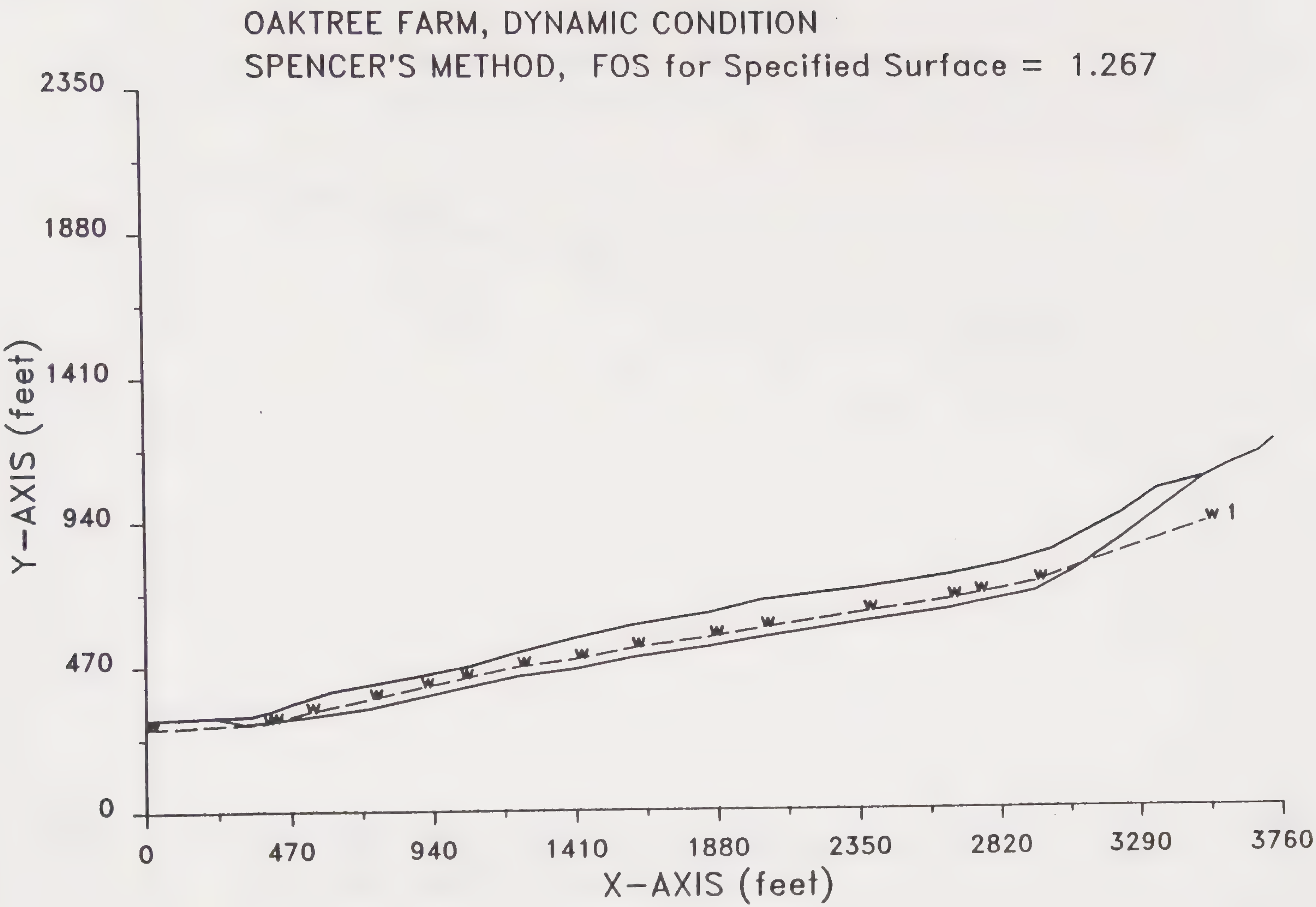
OAKTREE FARM, DYNAMIC CONDITION
SPENCER'S METHOD, FOS for Specified Surface = 1.682





OAKTREE FARM, STATIC CONDITION
SPENCER'S METHOD, FOS for Specified Surface = 1.999
2350
1880
1410
940
470
0
Y-AXIS (feet)
0
470
940
1410
1880
2350
2820
3290
3760
X-AXIS (feet)
w 1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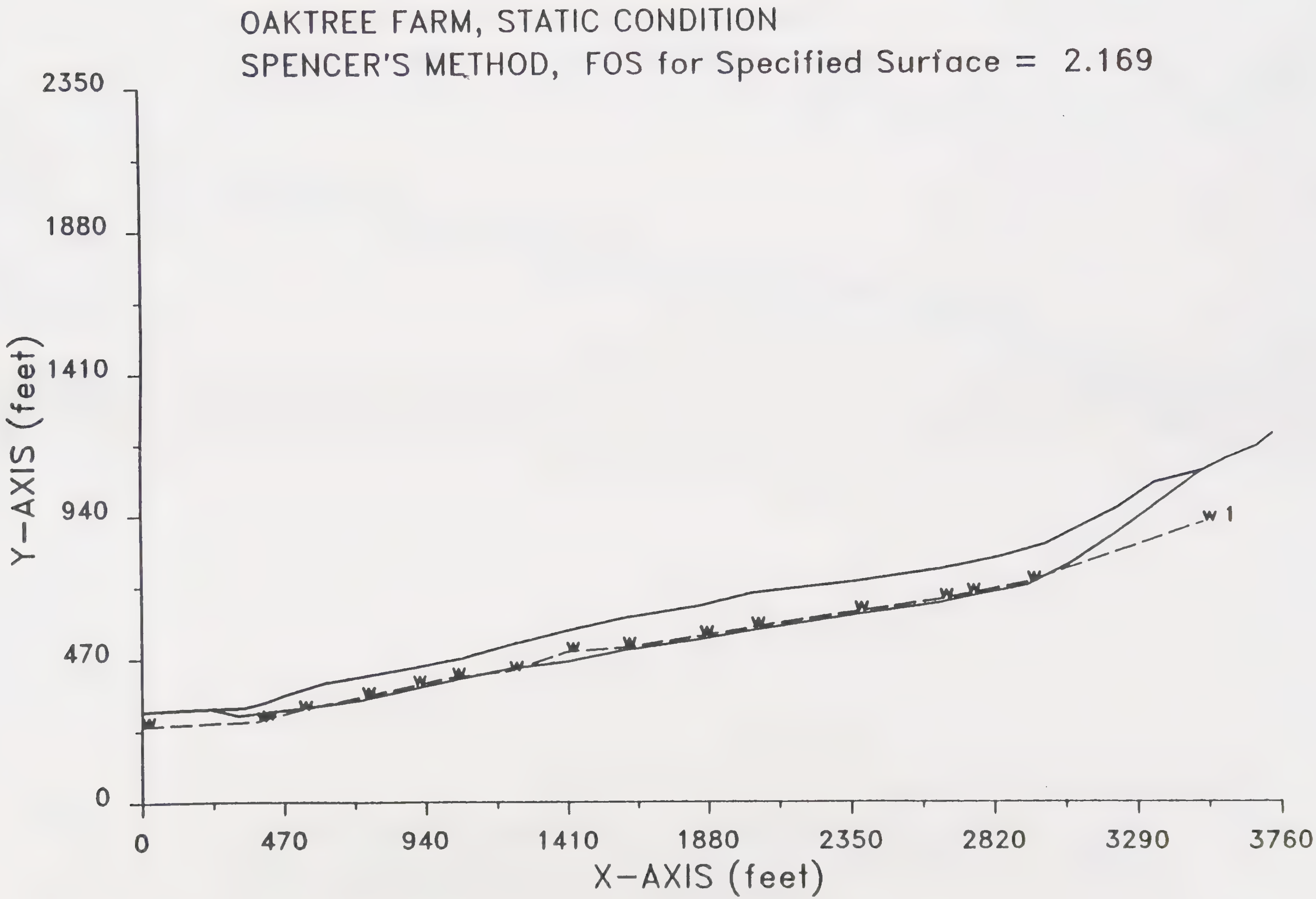
2350
1880
1410
940
470
0
Y-AXIS (feet)
0
470
940
1410
1880
2350
2820
3290
3760
X-AXIS (feet)
W 1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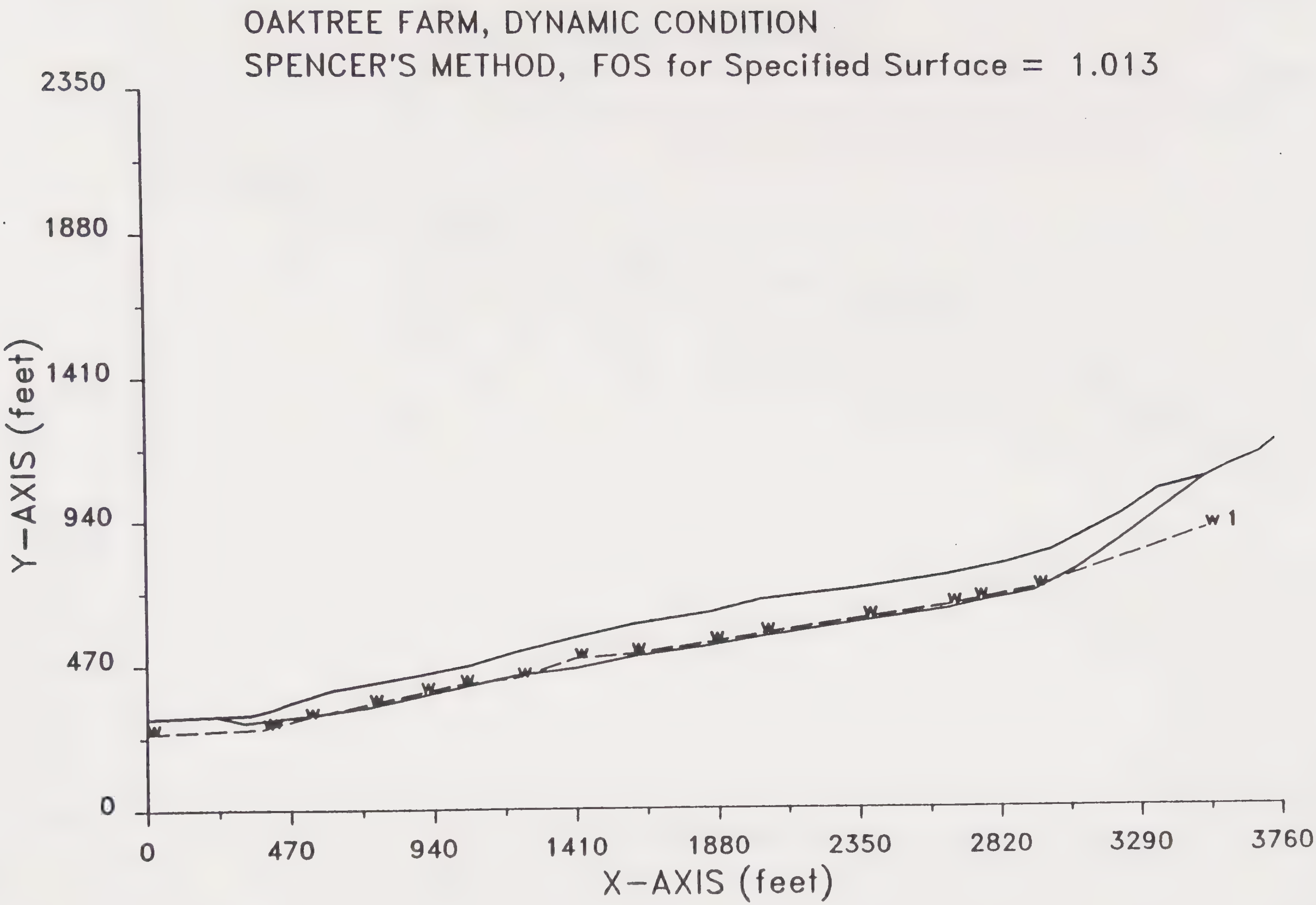
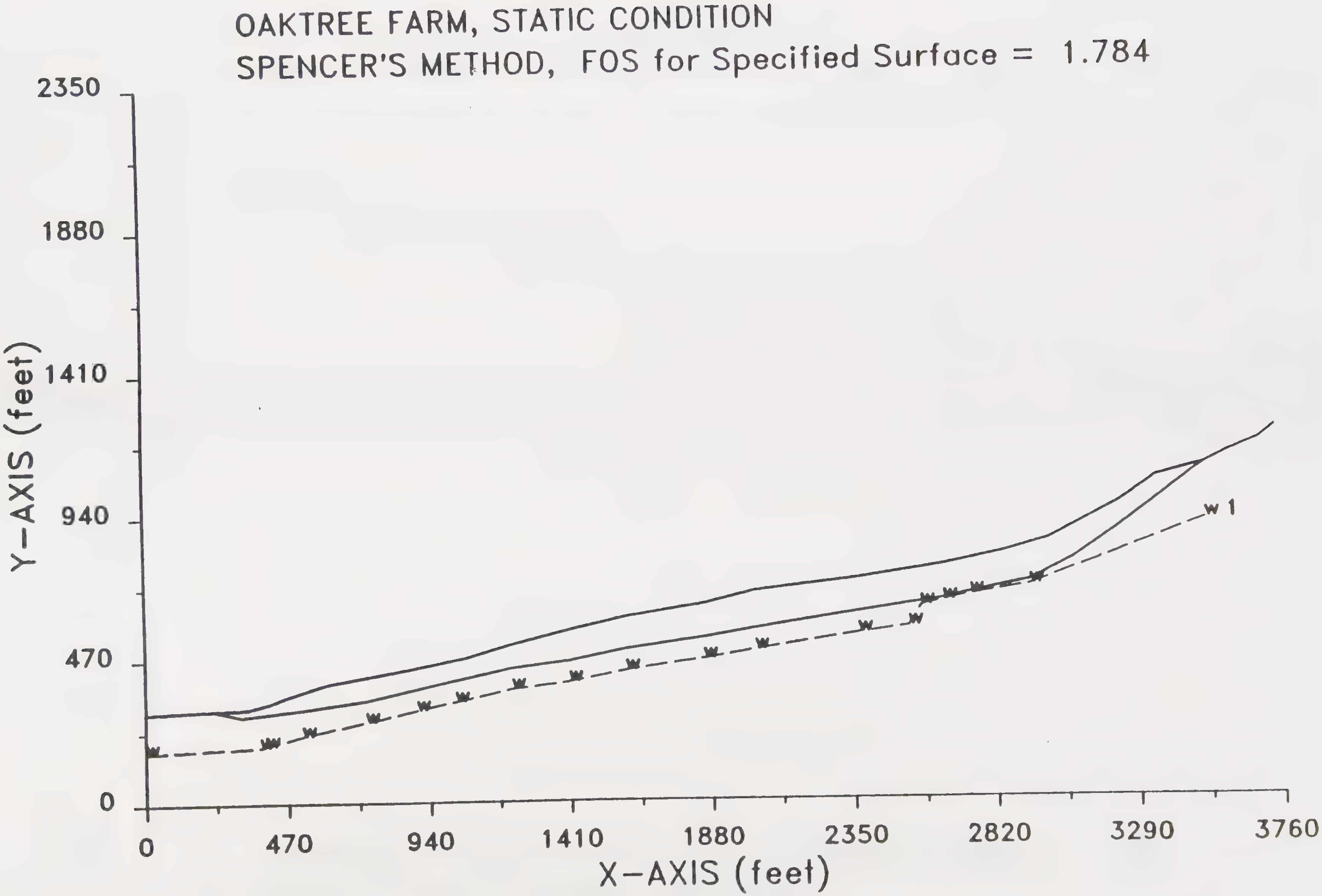
SPENCER'S METHOD, FOS for Specified Surface = 2.169
2350
1880
1410
940
470
0
Y-AXIS (feet)
w 1
0
470
940
1410
1880
2350
2820
3290
3760
X-AXIS (feet)

OAK4D 11-20-96 10:57



OAK5 11-20-96 10:58



OAK5D 11-20-96 10:58

OAKTREE FARM, DYNAMIC CONDITION

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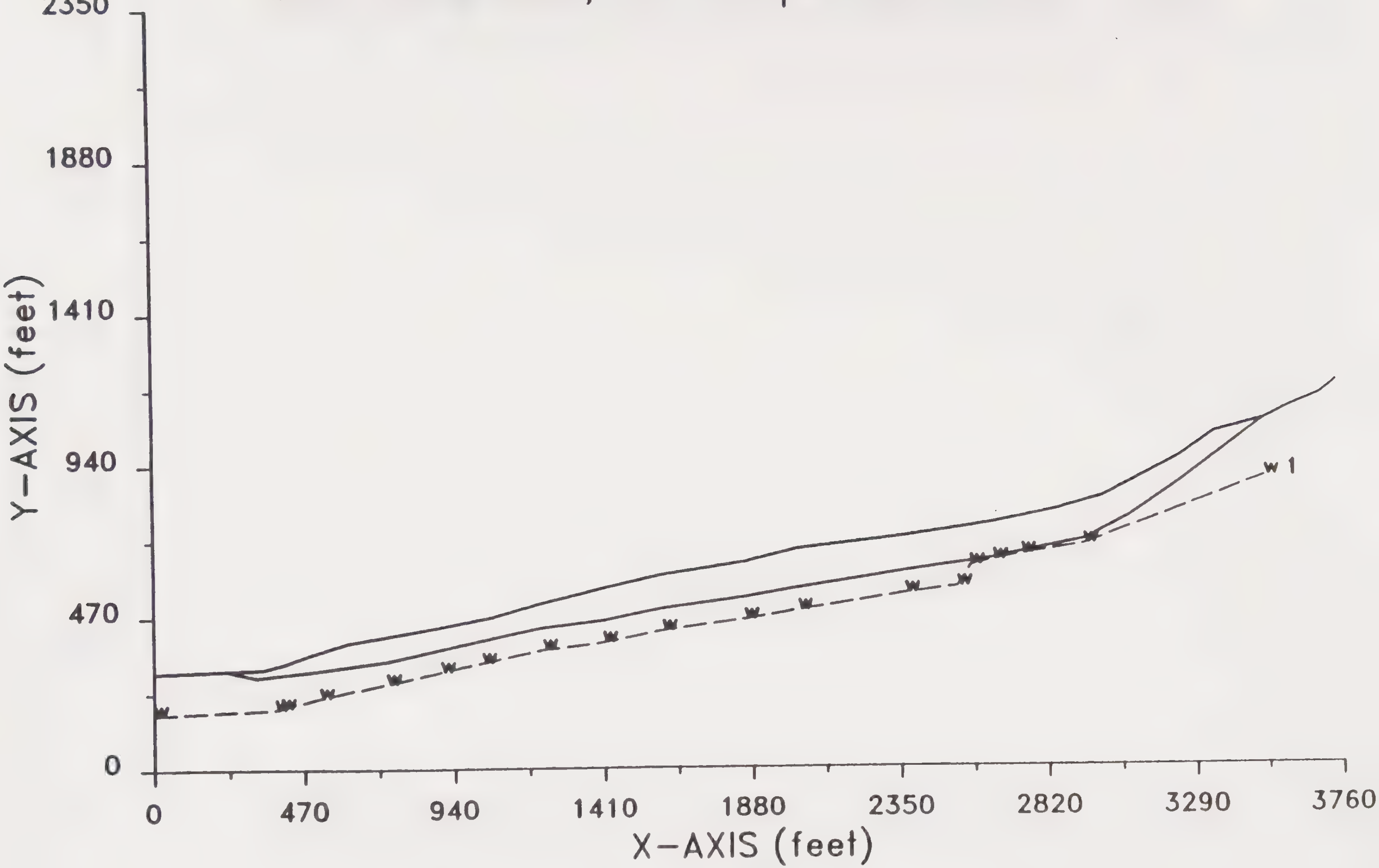
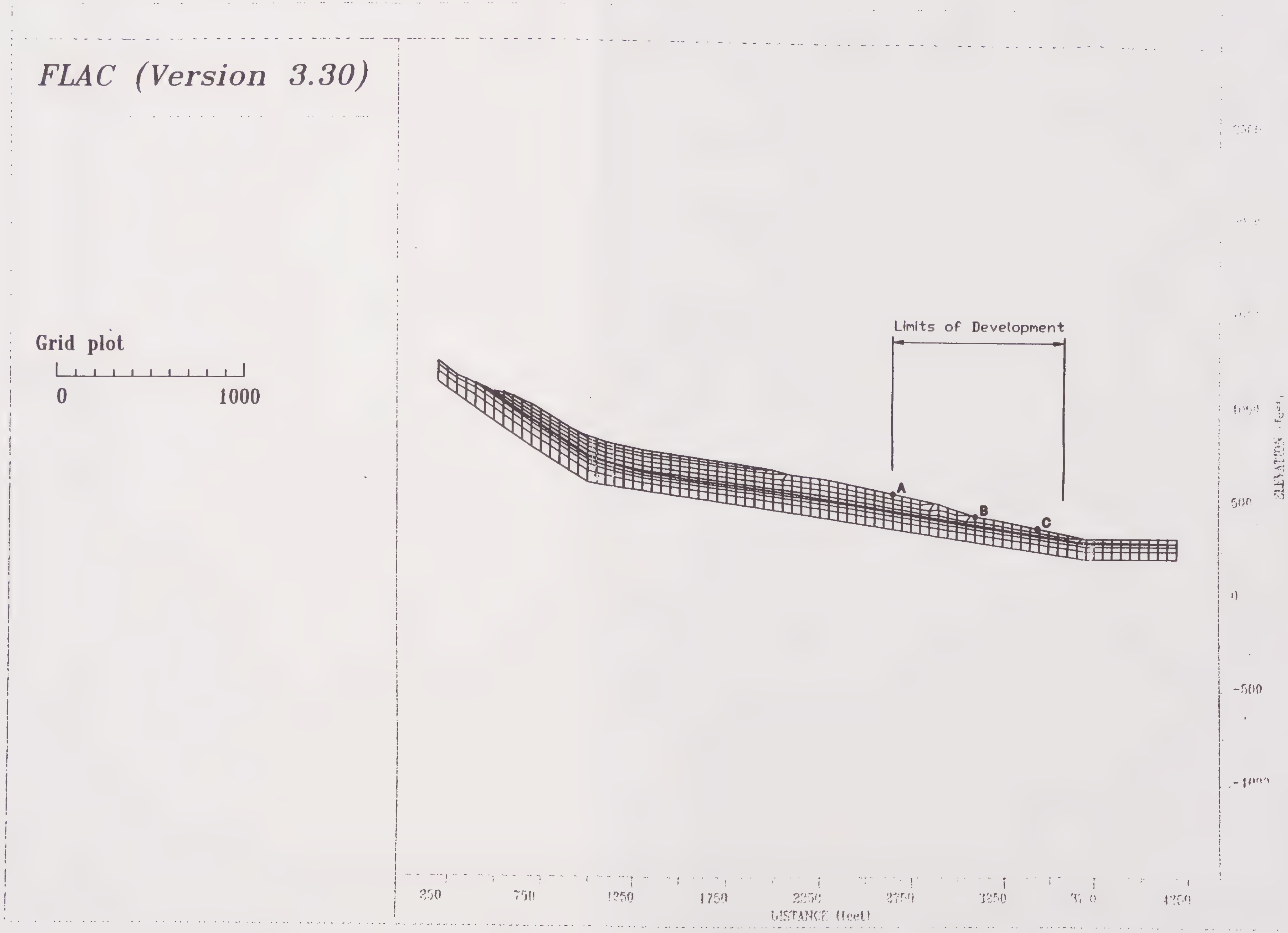


APPENDIX C



KLEINFELDER

FINITE ELEMENT MESH FOR DEFORMATION ANALYSES

OAK TREE FARM LANDSLIDE
PLEASANTON, CALIFORNIA

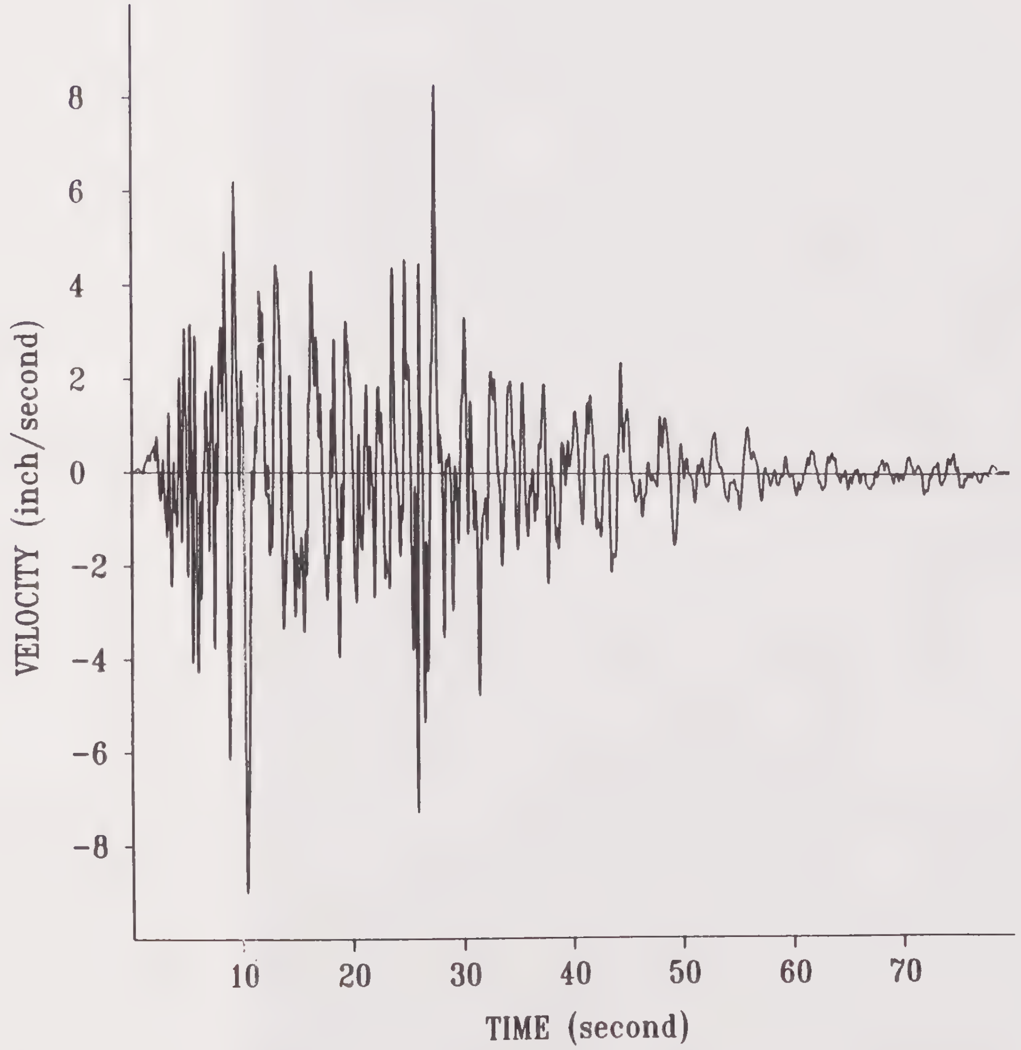
DRAFTED BY: L. Sue	DATE: 11-22-96	PROJECT NO. 10-300464-001	PLATE C-1
CHECKED BY: M. Tabatabaie	DATE: 11-25-96		

CAD FILE: C:_KA-PROJ\PLEAS\10300464\SEISMIC\G.dwg

FLAC (Version 3.30)

HISTORY PLOT
Y-axis :

X-axis :
Input Time

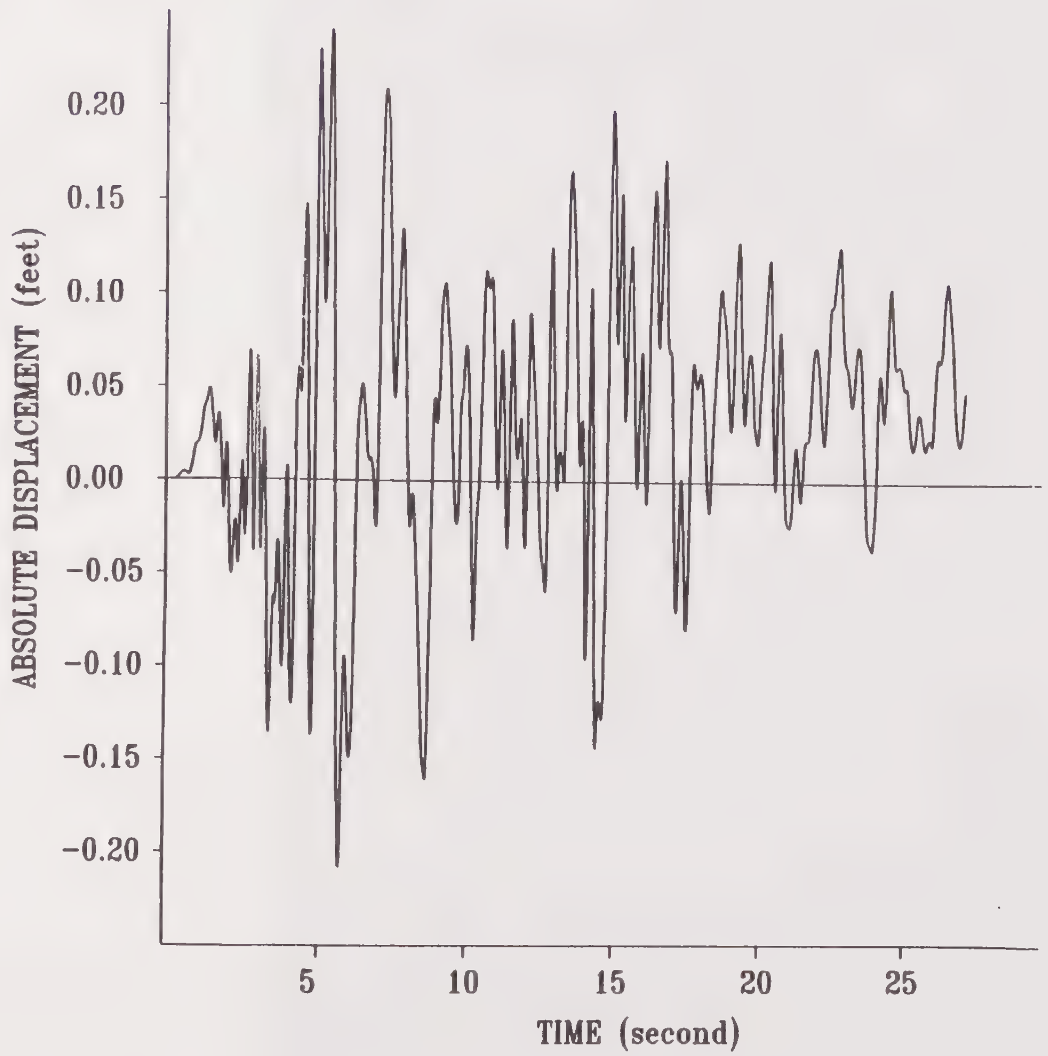


KLEINFELDER		INPUT VELOCITY TIME HISTORY AT BASE OF SLOPE: LOWER LEVEL EVENT AND LOWER BOUND SOIL PROPERTIES OAK TREE FARM LANDSLIDE PLEASANTON, CALIFORNIA	PLATE C-2
DRAFTED BY: L. Sue	DATE: 11-22-96		
CHECKED BY: M. Tabatabaie	DATE: 11-25-96	PROJECT NO. 10-300464-001	

CAD FILE: C:_KA-PROJ\PLEAS\10300464\SEISMIC\L1.dwg

FLAC (Version 3.30)

HISTORY PLOT
Y-axis :
X displacement(50, 8)
X-axis :
Number of steps



KLEINFELDER

DISPLACEMENT TIME HISTORY RESPONSE AT POINT A: LOWER LEVEL EVENT AND LOWER BOUND SOIL PROPERTIES

PLATE C-3

DRAFTED BY: L. Sue	DATE: 11-22-96	OAK TREE FARM LANDSLIDE PLEASANTON, CALIFORNIA
CHECKED BY: M. Tabatabaie	DATE: 11-25-96	PROJECT NO. 10-300464-001

CAD FILE: C:_KA-PROJ\PLEAS\10300464\SEISMIC\L3.dwg

FLAC (Version 3.30)

HISTORY PLOT
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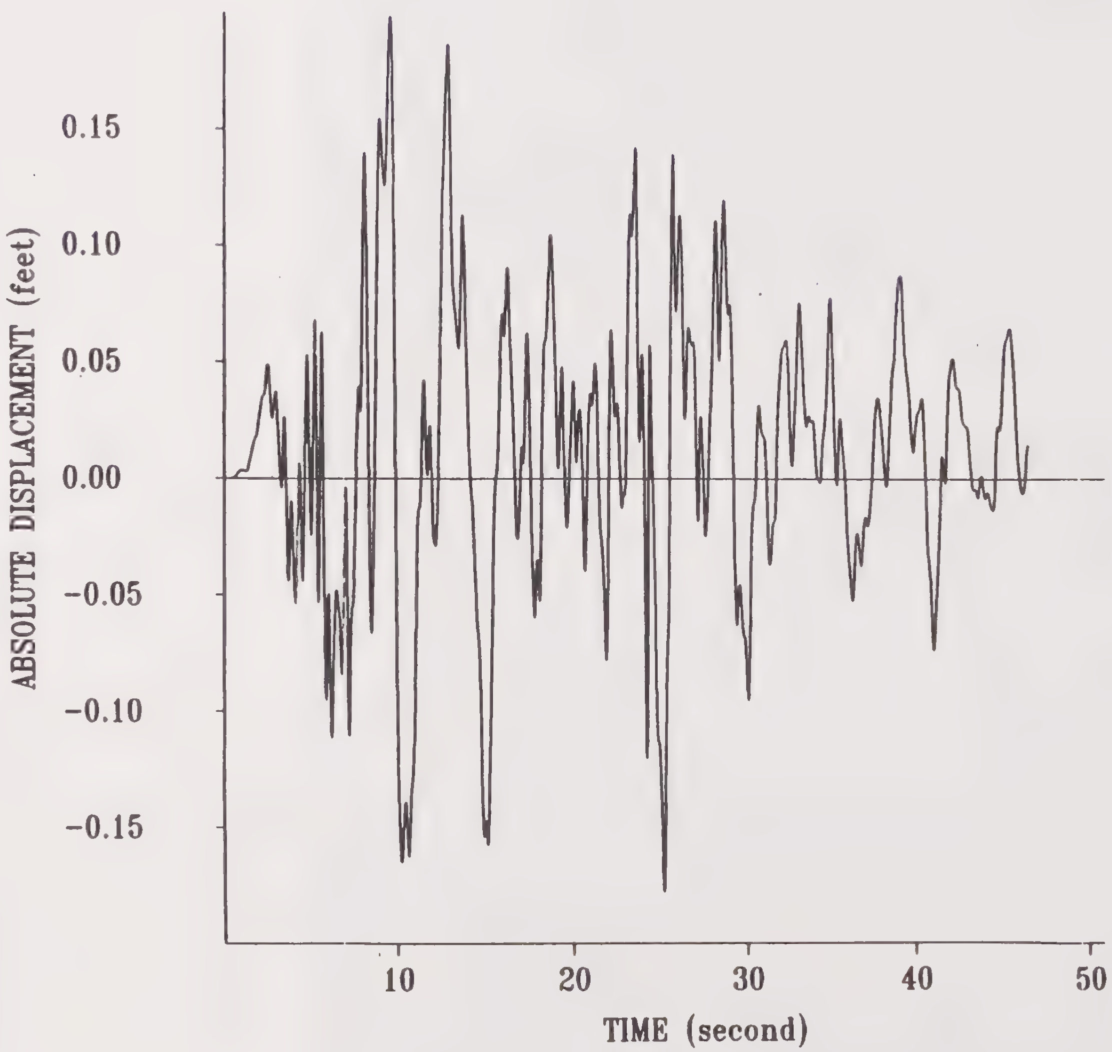
X displacement(59, 6)
X-axis :
Number of steps

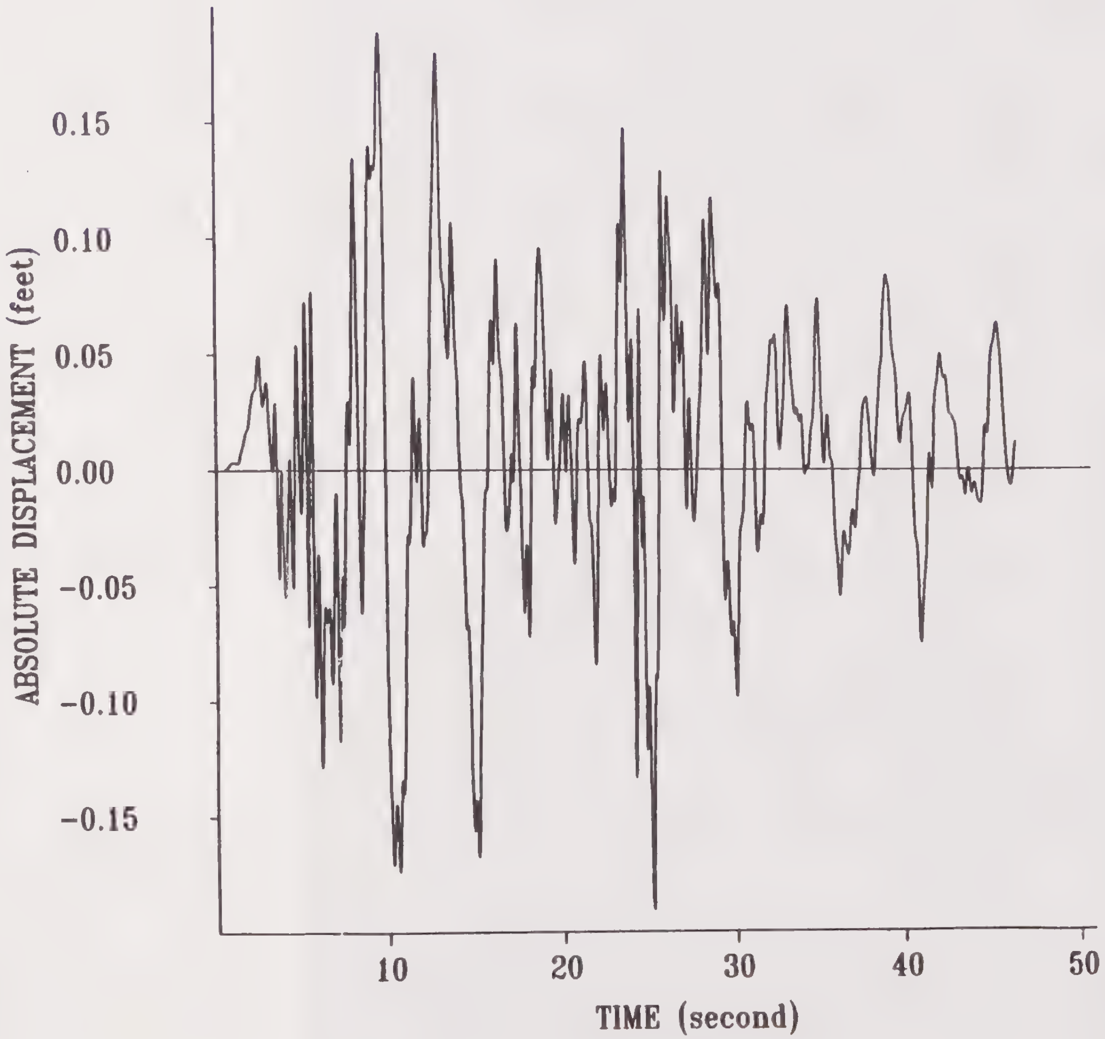


KLEINFELDER		DISPLACEMENT TIME HISTORY RESPONSE AT POINT B: LOWER LEVEL EVENT AND LOWER BOUND SOIL PROPERTIES	PLATE
DRAFTED BY: L. Sue	DATE: 11-22-96	OAK TREE FARM LANDSLIDE PLEASANTON, CALIFORNIA	C-4
CHECKED BY: M. Tabatabaie	DATE: 11-25-96	PROJECT NO. 10-300464-001	

CAD FILE: C:_KA-PROJ\PLEAS\10300464\SEISMIC\L5.dwg

FLAC (Version 3.30)

HISTORY PLOT
Y-axis :
X displacement(65, 6)
X-axis :
Number of steps



KLEINFELDER

DRAFTED BY: L. Sue DATE: 11-22-96

CHECKED BY: M. Tabatabaie DATE: 11-25-96

DISPLACEMENT TIME HISTORY RESPONSE AT POINT C: LOWER LEVEL EVENT AND LOWER BOUND SOIL PROPERTIES

OAK TREE FARM LANDSLIDE
PLEASANTON, CALIFORNIA

PROJECT NO. 10-300464-001

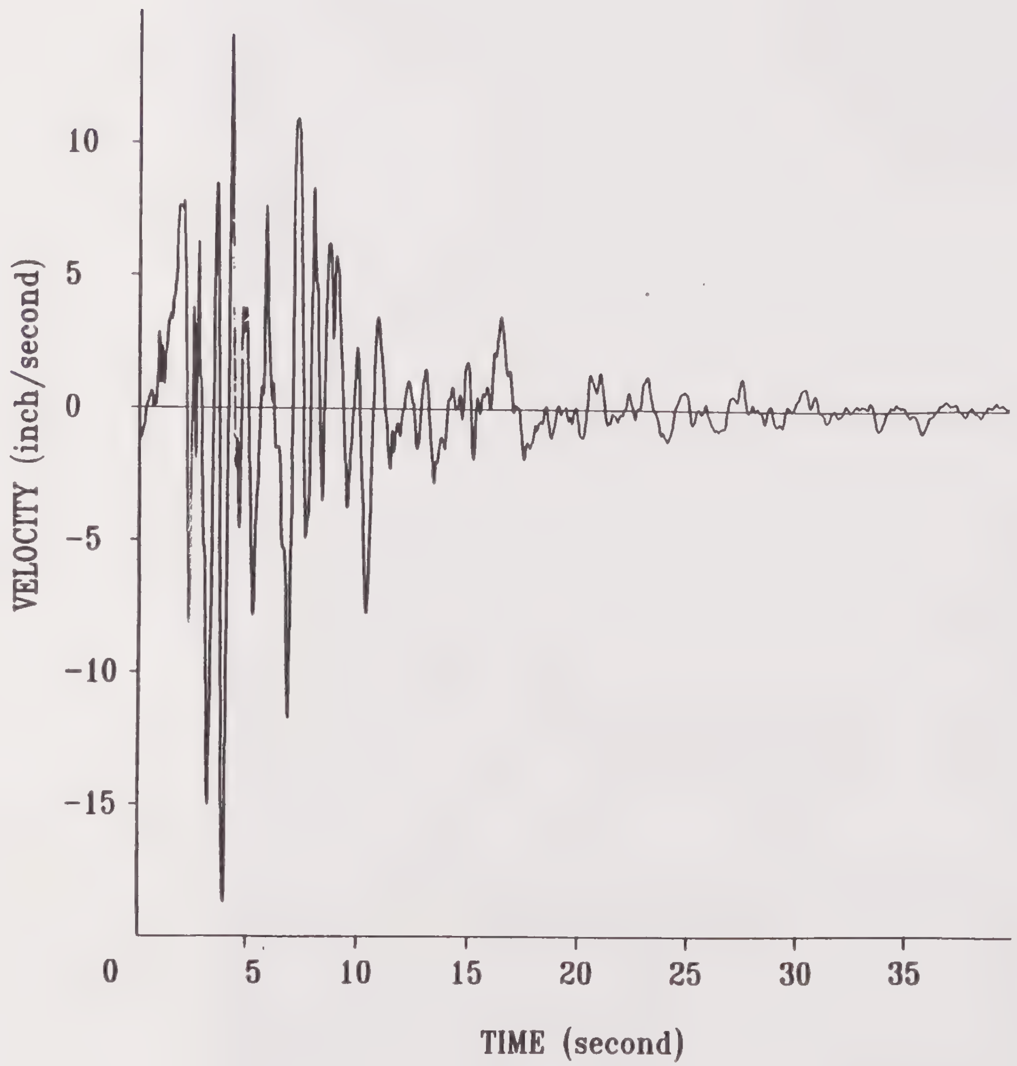
PLATE

C-5

CAD FILE: C:_KA-PROJ\PLEAS\10300464\SEISMIC\L7.dwg

FLAC (Version 3.30)

HISTORY PLOT
Y-axis :
2000 POINTS OF VELOC DATA
X-axis :
Input Time



KLEINFELDER

INPUT VELOCITY TIME HISTORY AT BASE OF SLOPE: UPPER LEVEL EVENT AND LOWER BOUND SOIL PROPERTIES

OAK TREE FARM LANDSLIDE
PLEASANTON, CALIFORNIA

PLATE C-6

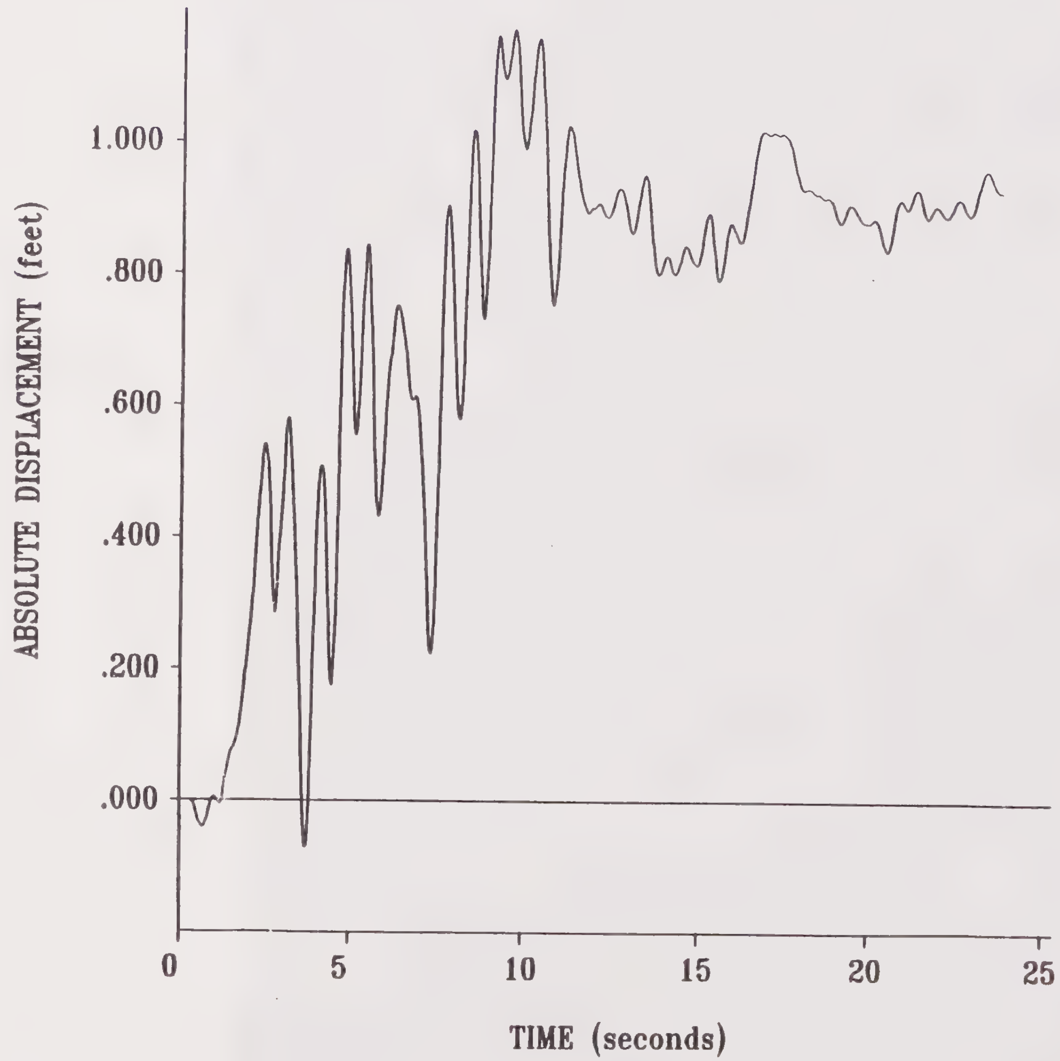
DRAFTED BY: L. Sue	DATE: 11-22-96
CHECKED BY: M. Tabatabaie	DATE: 11-25-96

PROJECT NO. 10-300464-001

CAD FILE: C:_KA-PROJ\PLEAS\10300464\SEISMIC\1.dwg

FLAC (Version 3.30)

HISTORY PLOT
Y-axis :
X displacement(50, 8)
X-axis :
Number of steps



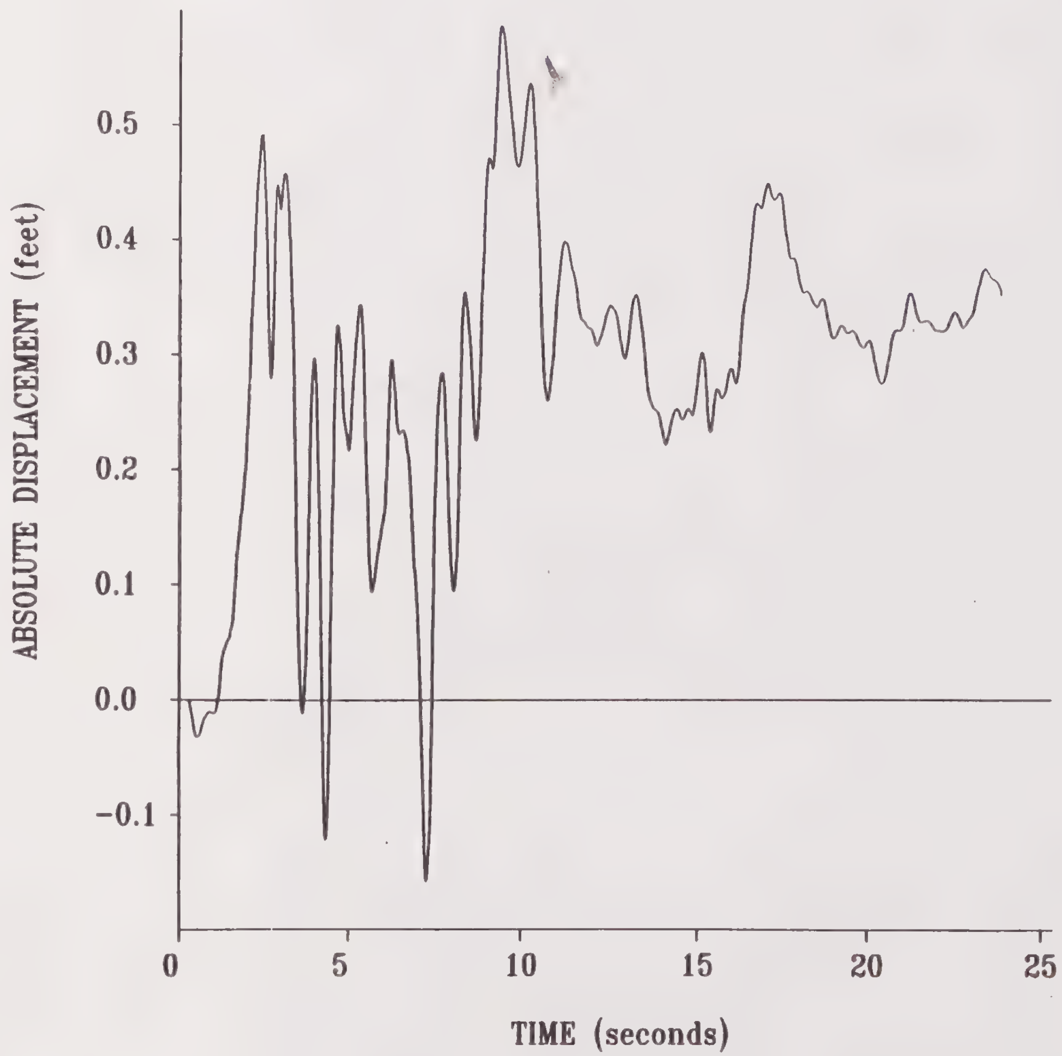
KLEINFELDER

DRAFTED BY: L. Sue	DATE: 11-22-96	DISPLACEMENT TIME HISTORY RESPONSE AT POINT A: UPPER LEVEL EVENT OAK TREE FARM LANDSLIDE PLEASANTON, CALIFORNIA	PLATE C-7
CHECKED BY: M. Tabatabaie	DATE: 11-25-96	PROJECT NO. 10-300464-001	

CAD FILE: C:_KA-PROJ\PLEAS\10300464\SEISMIC\3.dwg

FLAC (Version 3.30)

HISTORY PLOT
Y-axis :
X displacement(59, 6)
X-axis :
Number of steps



KLEINFELDER

DISPLACEMENT TIME HISTORY RESPONSE AT POINT B: UPPER LEVEL EVENT AND LOWER BOUND SOIL PROPERTIES

OAK TREE FARM LANDSLIDE
PLEASANTON, CALIFORNIA

PLATE C-8

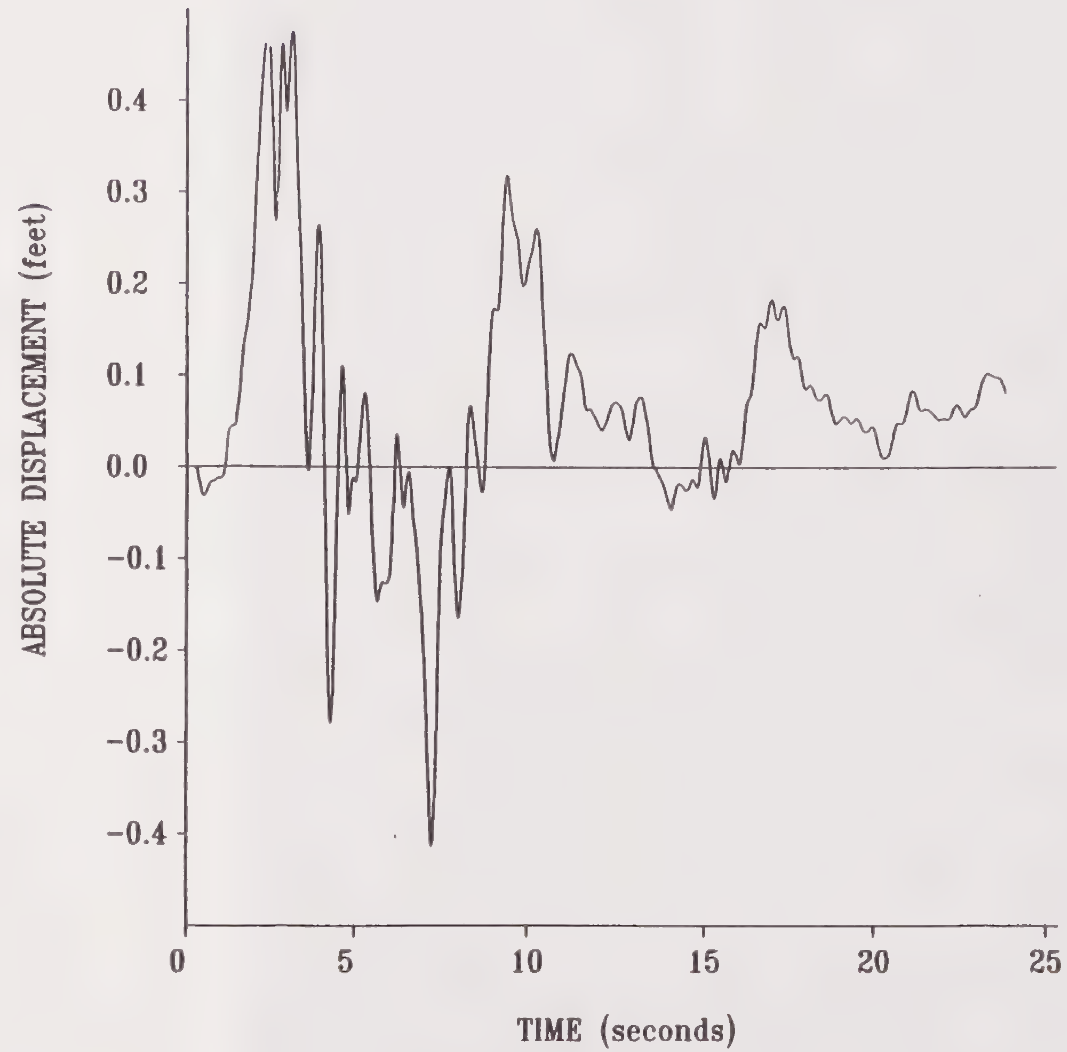
DRAFTED BY: L. Sue	DATE: 11-22-96
CHECKED BY: M. Tabatabaie	DATE: 11-25-96

PROJECT NO. 10-300464-001

CAD FILE: C:_KA-PROJ\PLEAS\10300464\SEISMIC\5.dwg

FLAC (Version 3.30)

HISTORY PLOT
Y-axis :
X displacement(65, 6)
X-axis :
Number of steps



KLEINFELDER

DISPLACEMENT TIME HISTORY AT POINT C: UPPER LEVEL EVENT AND LOWER BOUND SOIL PROPERTIES

OAK TREE FARM LANDSLIDE
PLEASANTON, CALIFORNIA

PLATE C-9

DRAFTED BY: L. Sue	DATE: 11-22-96	
CHECKED BY: M. Tabatabaie	DATE: 11-25-96	PROJECT NO. 10-300464-001

CAD FILE: C:_KA-PROJ\PLEAS\10300464\SEISMIC\7.dwg

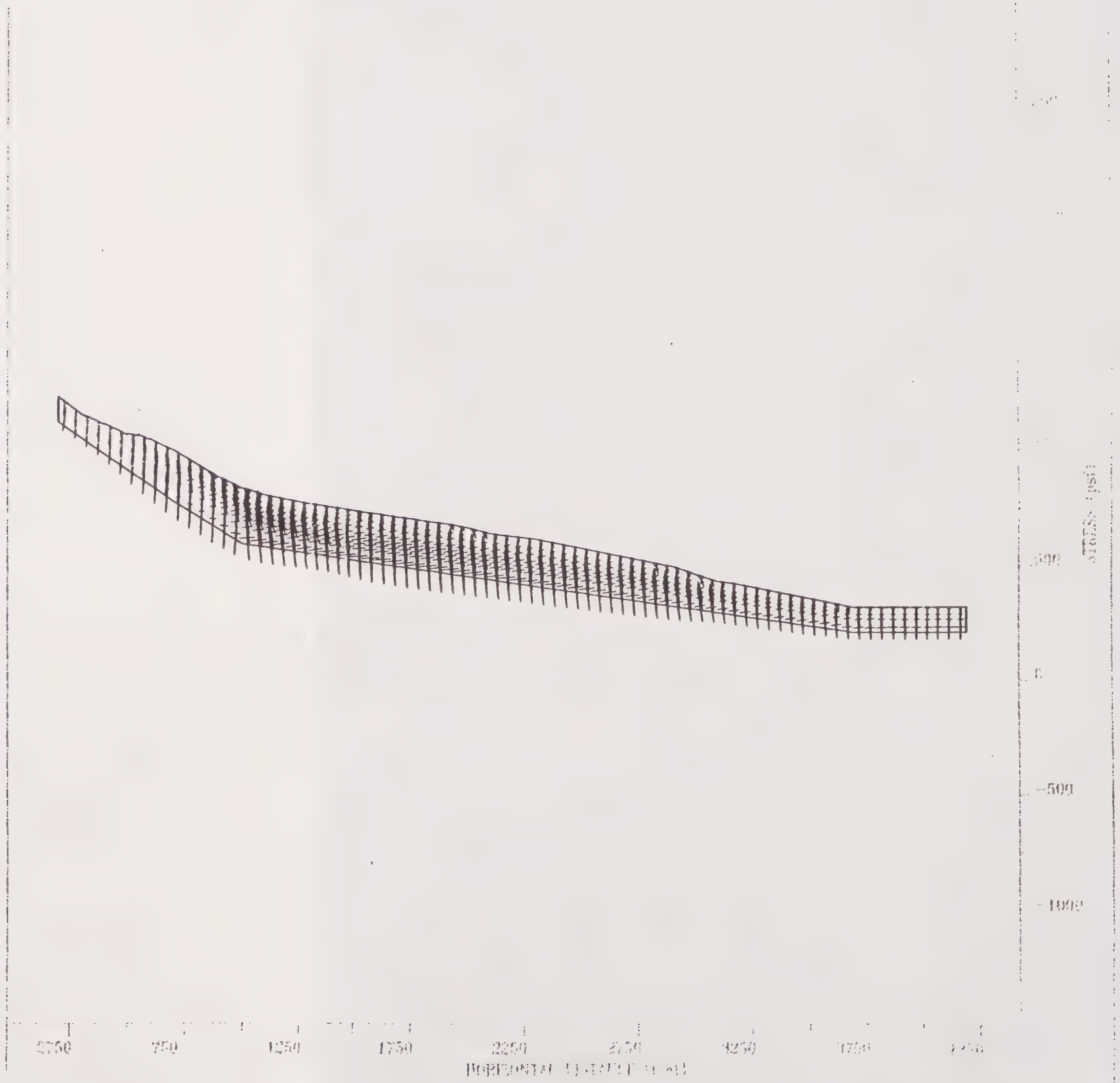
FLAC (Version 3.30)

Principal stresses
Max. Value = 25090

0 10000

Boundary plot

0 1000



KLEINFELDER	**INITIAL STRESS CONDITION** OAK TREE FARM LANDSLIDE PLEASANTON, CALIFORNIA	PLATE **C-10**
DRAFTED BY: L. Sue — DATE: 11-22-96		
CHECKED BY: M. Tabatabaie — DATE: 11-25-96	PROJECT NO. 10-300464-001	

CAD FILE: C:_KA-PROJ\PLEAS\10300464\SEISMIC\S.dwg

APPENDIX D

DRAFT

APPLICATION FOR AUTHORIZATION TO USE

STABILITY ANALYSES OF ANCIENT LANDSLIDE
OAK TREE FARM (TRACT 5629)
FOOTHILL ROAD
PLEASANTON, CALIFORNIA

TO: Kleinfelder, Inc.
7133 Koll Center Parkway, Suite 100
Pleasanton, CA 94566

FROM: ____
{Please clearly identify name and address of person/entity applying for permission to use or copy this document}

Gentlemen:

Applicant ____________________ hereby applies for permission to:
{State here the use(s) contemplated}

for the purpose(s) of:
{State here why you wish to do what is contemplated as set forth above}

Applicant understands and agrees that the "Stability Analyses of Ancient Landslide, Oak Tree Farm (Tract 5629), Foothill Road, Pleasanton, California" is a copyrighted document, that Kleinfelder, Inc. is the copyright owner and that unauthorized use or copying of " Stability Analyses of Ancient Landslide, Oak Tree Farm (Tract 5629), Foothill Road, Pleasanton, California" is strictly prohibited without the express written permission of Kleinfelder, Inc. Applicant understands that Kleinfelder, Inc. may withhold such permission at its sole discretion, or grant such permission upon such terms and conditions as it deems acceptable, such as the payment of a re-use fee.

Dated: ____________________ ______________________________
Applicant

by______________________________
Name

its______________________________
Title

GEOLOGIC AND GEOTECHNICAL UPDAT
FOR ANALYSIS OF
HILLSLOPE LOT DEVELOPMENT
OAK TREE FARM
(Tract 6898)
Foothill Road
Pleasanton, California
for
CURRIN CONSTRUCTION COMPANY

GEOTECHNICAL ENGINEERS AND GEOLOGISTS
TERRASEARCH INC.
SINCE 1969

GEOLOGIC AND GEOTECHNICAL UPDATE
FOR ANALYSIS OF
HILLSLOPE LOT DEVELOPMENT
OAK TREE FARM
(Tract 6898)

Foothill Road
Pleasanton, California
for
CURRIN CONSTRUCTION COMPANY

By

TERRASEARCH, inc.

Project No. 5541
19 November 1996

GEOTECHNICAL ENGINEERS AND GEOLOGISTS
TERRASEARCH inc.
11840 DUBLIN BOULEVARD, DUBLIN, CALIFORNIA 94568 (510) 833-9297 FAX (510) 833-9548

Project No. 5541
19 November 1996

Mr. Bill Currin
Currin Construction Company
8015 Foothill Road
Pleasanton, CA 94566

Subject: Proposed 14 Lot Residential Development
Oak Tree Farm, Tract 6898
Foothill Road
Pleasanton, California
GEOLOGIC AND GEOTECHNICAL UPDATE FOR ANALYSIS OF HILLSLOPE LOT DEVELOPMENT

Dear Mr. Currin:

At your request, we are pleased to submit herein an updated geologic and geotechnical evaluation of the hillslope stability with respect to the development of the subject lots. This report updates the work last performed by ***TERRASEARCH, inc.*** in 1992 by employing new developments in the analysis of seismic stability of landslides and performing more sophisticated analysis methods.

As part of our evaluation, we have consulted with Kleinfelder who will provide an independent review and perform a finite element deformation analysis of the large ancient landslide. The finite element deformation analysis is a more sophisticated approach to the methods previously used by ***TERRASEARCH, inc.*** in 1992 that will better assist in evaluating the stability of the ancient landslide.

Based on the work performed by ***TERRASEARCH, inc.*** and Kleinfelder, it is our opinion that the large ancient landslide will undergo relatively small horizontal deformation at the toe during an earthquake event along the Calaveras Fault and is considered stable and acceptable for the development of the proposed lots.

SINCE 1969
6840 VIA DEL ORO, SUITE 110, SAN JOSE, CALIFORNIA 95119-1348 (408) 362-4920 FAX (408) 362-4926

Some localized geologic and geotechnical constraints exist such as the smaller, recent slides and recommendations with respect to development of these lots including mitigation of unstable slides are presented in this report.

Should you have any questions or require additional information, please contact our office at your convenience.

REGISTERED PROFESSIONAL ENGINEER
SIMON MAKDESSI
C50307
Exp. 6-30-97
CIVIL
STATE OF CALIFORNIA

Very truly yours,
TERRASEARCH, inc.

Simon Makdessi, P.E.
Senior Engineer

Richard Rowland, C.E.G.
Senior Geologist

/tf

Copies: 4 to Currin Construction
1 to Kleinfelder (Attn: Mr. Michael Majchrzak)
2 to City of Pleasanton (Attn: Mr. Roger Higdon)

TABLE OF CONTENTS

INTRODUCTION

This report evaluates the impact of certain existing landslide features on a proposed residential development. The proposed development consists of creating a total of 13 new single family residential lots and an associated roadway. Four lots are planned downslope of the toe of a large ancient landslide and smaller recent slides in the center of the property; and nine lots are planned upon the lower level of the large ancient landslide to the north and within a nest of smaller ancient, recent and active slides.

Previous studies have been performed by ***TERRASEARCH, inc.*** (TI) in 1992 addressing the stability of a large ancient landslide and a number of smaller ancient but more recent and active slides. Three reports were submitted (***TERRASEARCH, inc.***, 1992a, 1992b, 1992c) which presented our evaluation of stability of these landslide features for tentative map approval of 54 lots. Our work essentially concluded that the large ancient landslide was stable and would undergo insignificant levels of deformation during an earthquake event along the Calaveras Fault and that a number of smaller landslide features would require mitigation. The City of Pleasanton's geologic and geotechnical reviewer, Berlogar Geotechnical Consultants (BGC), opined that the large ancient landslide was not stable, particularly under seismic conditions and development upon and within 100 feet of the toe of slide should not be allowed. This affected a total of 16 lots and the City adopted BGC's recommendations.

Since that time, there have been developments in the field of seismic evaluation of landslide stability. This report employs these recent developments in order to evaluate whether the conclusions previously made by ***TERRASEARCH, inc.*** are valid. In order to assist and complement our work, Currin Construction Company retained Kleinfelder.

This study focuses on the central and northern portion of the property where the 14 lots are affected by landslides. The purpose of our work was to:

a) update the geologic and groundwater conditions primarily in the vicinity of the 10 lots proposed on the hillside;
b) perform a deep boring in this area to evaluate the depth of the large ancient landslide and current groundwater conditions;
c) update the soil strength data along the slide plane(s);
d) analyze a new cross section for static and pseudo-static stability;
e) provide general geotechnical recommendations that may affect development of the subject lots.

The purpose of the work by Kleinfelder was to:

a) perform a review of our work;
b) update the seismic design parameters;
c) perform a finite element deformation analysis of the large ancient landslide to evaluate its stability.

The finite element deformation analysis is a more sophisticated approach to determining the estimated movements of a slide mass compared to the simplified deformation analysis performed by ***TERRASEARCH, inc.*** in 1992.

This report is intended not only to update previous analyses, but also to be a near complete stand alone document. We will include a complete new geology map showing updated geologic and landslide conditions, the locations of all borings and test pits performed for the entire Oak Tree Farm project, and the logs of the borings and test pits with a summary of pertinent laboratory data attached for ease of reference.

The City of Pleasanton hired Alan Kropp & Associates (AKA) to be the City's geotechnical reviewer for this project. Lettis & Associates (LA) were retained by AKA to provide geologic review. Because of the scale and uniqueness of the work and the amount of new published and unpublished information, a number of meetings were held with TI, Kleinfelder, AKA and LA, to share the available information and to arrive at a consensus on the general methodology of analysis and evaluation to be employed.

METHODOLOGY OF ANALYSIS

Prior to performing any stability evaluation, it is important to establish an analysis procedure for the conditions at hand. Research of local, national, and international procedures for the stability analysis of natural or man made slopes revealed essentially uniform practice in the analysis of static conditions, and variable practice in the analysis of dynamic (seismic) conditions. The following discussion outlines general current states of practice with respect to analysis of landslides and includes the methods used in our previous work in 1992 in addition to those that will be used for this document.

Analysis Methods

In general the steps involved in performing an evaluation of slope stability using current analytic tools are as follows:

1. static slope stability using limit equilibrium techniques;
2. pseudo-static slope stability using limit equilibrium techniques and a seismic coefficient;
3. simplified deformation analysis based on Newmark approach (e.g. Makdisi Seed, Hynes-Griffin);
4. deformation analysis using a recorded or synthetic earthquake and to calculate the time history acceleration of the slide;
5. deformation analysis using finite element or finite difference technique.

Each successive step requires a higher level of analysis than the preceding step and ranges from simple to very sophisticated. The analysis results of Step 1 and Step 2 are presented as factors of safety and the slope is considered stable and acceptable if the safety factor is higher than a certain generally accepted value (see later). The results of analysis Steps 3 to 5 are in the form of displacement/deformation of the slope surface or slide mass and the acceptable stability of a slope is determined by evaluating the order of magnitude of the displacements and their effect on the slope or any structures upon the slope.

A recent informal survey via telephone, of local practitioners and academics in the field of geotechnical engineering, by ***TERRASEARCH, inc.*** and Alan Kropp and Associates revealed a variation in the sequence of steps that are taken, and are summarized as follows:

a) Perform Step 1. If static factors of safety are very high (say >2) then no need to proceed further.

b) Perform both Steps 1 and 2. If factors of safety are acceptable for both, stop here and proceed no further. If factor of safety in Step 2 not acceptable, then perform Steps 3 and/or 4.

c) Perform Step 1 and the Steps 3 and/or 4 without performing Step 2.

d) Perform Step 1 and proceed straight to Step 5.

The survey revealed that the most commonly used approaches were that of approaches b) and c).

On September 12, 1996, the State Mining and Geology Board of California unanimously approved a document entitled "Draft Guidelines for Evaluating and Mitigating Seismic Hazards". The document was prepared as part of the Seismic Hazards mapping Act passed by the California State Legislature in 1990. Essentially the objectives of the Guidelines are

1. To assist in the evaluation and mitigation of mapped earthquake-related hazards for projects within designated seismic hazard zones; and

2. To promote uniform and effective statewide implementation of the evaluation and mitigation elements of the Seismic Hazards Mapping Act.

The document covers a number of seismic related issues and the issue of analysis of landslide is covered in Chapter 5. The previously mentioned analysis steps are discussed in that Chapter, however, the sequence or type of steps required for an analysis is not given.

The procedure previously used by ***TERRASEARCH, inc.*** included performing Steps 1 through 3. Because the pseudo-static analysis performed by ***TERRASEARCH, inc.*** in 1992 shows low safety factors for a certain range of strengths, the next step in the analysis for this current evaluation will be to perform a finite element deformation analysis. The advantages of this analysis over the other more simplified ones is that the slide mass is not modeled as a rigid body and the magnitude of deformation over various parts of the slide mass can be calculated.

Physical Properties

The main physical factors of a slide affecting slope stability are:

- i) geometry of slope and slide plane
- ii) type of slide and soil/bedrock profile
- iii) groundwater conditions
- iv) strength properties of slide plane and slide mass
- v) presence of static or dynamic loads.

With good surface geologic mapping, aerial photo interpretation and investigative drilling, conditions i), ii), and iii) can be reasonably well defined.

A new cross-section, 12-12', was evaluated, the location of which is shown on Figure 1. This new section was selected so that it traversed through the area where the nine lots located upon the large ancient landslide and where deformations of the slide during an earthquake could be calculated along some of these lots.

Shear Strength

Subsurface conditions can vary in nature, sequence and lateral extent from one location to another. This would be particularly evident in the large size of the ancient and recent slides, and variations in subsurface conditions, especially along a slide plane which had moved a relatively large distance, should be expected. The suite of laboratory testing, empirical relationships and back analysis performed in 1992, will assist in selecting appropriate shear strength values and different shear strengths will be used to evaluate the sensitivity of the stability of the slide to shear strength. A review of the literature and verbal communication

with other practitioners and academics indicate that, for existing slides, residual shear strength values (with cohesion equal to zero) should be used for static stability and peak effective strength values for dynamic stability. Total stress analysis can be used for clayey soils that may exhibit small increases in pore pressure during cyclic (earthquake) loading; however, 80% of the undrained strength is recommended for use in the analysis. This latter approach was developed mainly for earth embankments and will not be used here.

The method previously used by ***TERRASEARCH, inc.*** with respect to material strength properties was essentially within the current approach; however, there previously existed some disagreement between TI and BGC with regard to the actual strength values used.

Seismic Coefficient

The selection of an appropriate seismic coefficient for use in pseudo-static analysis has been a somewhat contentious and debated issue in the geotechnical field for some time due to the variable and not fully understood nature of movement of earthquake energy through soil and bedrock masses. Methods used over the years for determining the seismic coefficient have included rule of thumb, local experience, analysis and observation of existing slopes that have failed and withstood earthquakes, to theoretical approaches based on a one dimensional site response analysis using an actual or synthetic acceleration time history of an earthquake event.

Dynamic loads due to earthquakes are typically represented as a single horizontal force having a magnitude equal to a certain percentage of the slide mass. This percentage is commonly referred to as a seismic coefficient and is expressed as a percentage of gravity. This horizontal force is then used in the static analysis to obtain a factor of safety against sliding. Dynamic loads due to earthquakes move back and forth and up and down in various directions and representing these loads as one horizontal load is an oversimplification. For this reason, the analysis is called a pseudo-static analysis as it is modelling dynamic loads as static loads. It is generally accepted that this approach is a conservative one.

In the recent survey, the maximum seismic coefficient used by the geotechnical practitioners and academics for analysis close to an active fault ranged from 0.15g to 0.30g. The current consensus of opinion is that the selection of the seismic coefficient using a peak horizontal ground acceleration (PGA) is not appropriate and is stated in the 1996 Draft Guidelines. This was one method that was previously used by ***TERRASEARCH, inc.*** in our earlier work. For

the current analysis, an approach recently presented by Ashford and Sitar (1994) will be considered.

Evaluation of Acceptable Stability

The stability analysis results are reported as a safety factor, which is the ratio of resisting loads over driving (sliding) loads. Failure of a slope occurs when the factor of safety falls below 1.0. An acceptable factor of safety must take into account uncertainties in the design parameters and modelling and also consequences of failure. The generally accepted industry standard for acceptable stability is a safety factor to be greater than 1.5 for static conditions. For seismic conditions, the factor safety varies from 1.0 to 1.15 depending on the probability of occurrence of a seismic event and method used to calculate the seismic coefficient.

For this study the acceptable factor of safety for seismic conditions will be 1.0. It should be noted that if the factor of safety falls below 1.0 in the pseudo-static analysis, it does not imply failure. The results imply that the slide mass will, over a certain time period (order of seconds) have a safety factor less than 1.0 when the acceleration is greater than a certain value, and that during these periods, certain minor displacements of the slide could occur.

It should be noted that the quoted accepted levels of safety factor are not absolute but are merely intended for use as an industry accepted guideline in assessing stability. A static safety factor lower than 1.5 may be appropriate if sufficient and good quality data has been gathered and conservative conditions are used. If insufficient or poor quality data has been gathered, then a static safety factor higher than 1.5 would be more appropriate.

Currently there are no specific standards of practice with acceptable levels of deformation; however, the 1996 Draft Guidelines evaluate failure when displacements of 5 to 10 cm (2 to 4 inches) are calculated. The Draft Guidelines do not specify what kind of deformation but do state that the results should be considered as order of magnitude only. It is our opinion that the differential deformations are more critical than the total deformation. The order of magnitude of acceptable deformation should be based on the type of structures involved. It is noted that movements of 4 to 6 inches are possible for critically expansive clay, and that the acceptable level of deformation presented in the 1996 Draft Guidelines may be too strict.

GEOLOGY

Geologic Setting

Published regional mapping (Hall, 1958 and Dibblee, 1980a,b) shows the eastern flank of the Pleasanton Ridge as marking the boundary between Cretaceous marine sediments under the Ridge and younger marine and non-marine sediments in the Livermore Basin. The contact is marked by the Calaveras Fault, a known active fault. The "Earthquake Fault Zone" area, in which the State of California requires seismic investigations, is located about 1000 feet southwest of the subject development area. In the site vicinity, the fault itself is concealed under a massive landslide complex that extends for many miles along the eastern flank of the Ridge. Herd (1978) and Nilsen (1973) show the landslides extending from one mile south of Oak Tree Farm to about 2.5 to 4.0 miles to the north. Herd (1978) has delineated a single landslide within this complex approximately as shown on Figure 1. This feature, which is about 3,000 feet long in the downslope direction and 2,000 feet across, is the deep ancient landslide that is the subject of this study.

Dibblee shows rocks on the west side of the Calaveras Fault to consist of Upper Cretaceous marine sediments of the Panoche Formation. On the east side he has delineated three distinct units. The deepest and oldest, with the smallest area of surface exposure, consists of Miocene sandstone and minor siltstone and shale. The most widespread unit is the Livermore Gravel of Pliocene and/or Pleistocene Age. This terrestrial unit consists of reddish-gray pebble-cobble gravel with minor sand and clay. Stratigraphically between these two units Dibble has mapped nonmarine sedimentary rocks of Pliocene Age ("Tps"), consisting of "gray to reddish-gray pebble conglomerate and greenish gray mudstone".

Surface Geologic Mapping

A review of the surface features of the subject development area was made as part of our geologic update,and several small features were observed in addition to those previously mapped. These features were added, and local corrections were made, to the original consensus geologic map that occurred in our previous reports as the "Geotechnical Plan". The

corrections and additions were all made in the area lots of the subject development, and they are shown on the updated Geotechnical Plan given as Figure 2 in this report.

As a result of our update, an additional landslide category has been added to our classification scheme. The smaller features that appear to have been active in most recent decades are still part of the "Qa" classification. However, some of the "Qlr" landslides contain surface features indicative of possible or probable activity within the last 500 years. Therefore, these areas could be considered as being affected by the current climatic regimen and, therefore should be considered as "active". Many or most of these areas are portions of the "intermediate size landslides" designated for repair in our 1987 report. These areas have now been designated as "Qlao" (older active landslide) on our current site plan (Figure 2). The remainder of the "Qlr" landslides, as well as the "Qlo" areas, are still defined as in our 1992 reports.

Subsurface Findings

Prior to this study, most of the data concerning the "Ancient Landslide" ("Qlo") was derived from a line of borings located along its south flank (Borings A, 1, 2, 40, 41, 54, and 55). Hence, it was decided to drill Boring 56 in order to obtain data relating to the landslide depth and groundwater conditions in the northern part of the site. B-56 was located 270 feet southeast of B-48, which previously was the only boring considered to have penetrated beneath the ancient (deep) landslide in the area of the proposed development. B-48 was a core-hole advanced to a depth of 104 feet. After coring a portion of a redwood log at a depth of 74 feet, it was decided to extend the depth of coring. The depth of the landslide in B-48 was based on the lowermost extent of chaotic mobilized texture (80 ft.). Below 80 feet the section appeared to be an undisturbed section of interbedded, grayish-green to blue-gray, fine to coarse-grained, variably clayey sand and sandstone, with minor sandy clay. More details on the findings of B-48 can be found in our report dated 8 July 1992 (Revised 4 August 1992).

B-56, drilled as part of this study, was not a core hole. Drive samples were taken every 5 feet beginning at a depth of 50 feet. In contrast with B-48, B-56 appeared to bore through a section composed primarily of silty clays and clayey silts with lesser amounts of sands and gravels. Hard gravelly zones were encountered at 38-48 and 71-88.

In B-56, the samples from 85 to 86.5 appeared more moist and weathered, with interstitial gypsum. The samples at 90 feet and below were primarily blue gray to gray-green, massive clayey silt and silty clay. Therefore, the base of the ancient landslide was placed at 88 feet. Some interbeds of gravelly sands and sandy gravels occurred between 96 and 108 feet. The massive,relatively uniform sections of blue-gray clayey silt appear to represent a near-shore or marine environment rather than a terrestrial one. This facies may belong to the "Tps" (Pliocene) unit mapped by Dibblee (1980).

Groundwater Conditions

A permanent groundwater table on the hillslope portions of Oak Tree Farm has been found only at great depths. This is a marked contrast from conditions in the Castlewood landslide immediately north of the site where groundwater tables are relatively high (on the order of 20 to 30 feet below ground surface) and are coupled with a flatter overall slope angle. This may be partly due to less permeable soils in the Castlewood landslide as well as diversionary effects of an impermeable Calaveras Fault Zone.

Of the 36 borings and core holes located on the hillslope, only six (Borings A, 3, 41, 42, 47, and 52) reached the top of what could be considered a groundwater table. It should be noted that twelve of the borings (B-40 through 51) were drilled by rotary wash method and a groundwater level might have been masked in some of these. Of the six aforementioned borings, five were drilled in the Springtime. Only one of these six (B-47) was located in the immediate vicinity of the proposed lots (See Figure 2). B-47 was a rotary wash core hole drilled to 60 feet in which a piezometer was then set to 59 feet. As can be seen from Table I, only 2 feet maximum of water above the bottom of this piezometer was measured before it went dry in the Fall of 1992. The B-47 readings probably represented a transitory, localized, perched aquifer. (Unfortunately, B-47 was lost or destroyed and could not be read this year.) In order to obtain additional groundwater data in the subject development area, B-56 was drilled to 121 feet with piezometer set at 120 feet and no water was encountered during drilling or 2 days after drilling.

Of the other five readings: Boring A (wide-diameter) was located near the base of the slope; B-3 was located in the southwest corner of Oak Tree Farm near a stream that was flowing at the time it was drilled (June 1986); and B-41, 42, and 52 gave readings below the basal slide

plane, at around 250, 105, and 125 feet, respectively (B-42 and B-52 are located off-site near the top of the ancient landslide.)

Perched water was encountered during the drilling of B-1, B-2, B-41, B-52 and B-54. In the case of B-1, B-2, and B-54, the water became sealed off and the holes were dry at conclusion of drilling. In B-41, B-42, and B-52, separate piezometers were installed to monitor the upper parts of these holes (the piezometer for B-42 is labeled B-53). Except for one questionable reading on 28 September 1992, the upper 175 feet of B-41 has been dry. B-42 (B-53) and B-52 are located off-site as shown on Figure 1. These borings are in an area containing an impermeable aquiclude that supports water derived from upslope perennial springs. As a result, the water level readings are the most consistent of any in this study. This condition, which occurs on both sides of the Calaveras Fault, apparently does not extend downslope as far as Oak Tree Farm.

Faults do typically act as impermeable zones which can allow groundwater to back up upslope of the fault zone. Although a deep regional groundwater table and high perched groundwater conditions were encountered on the west (upslope) side of the fault, we will analyze the stability of the ancient landslide with a conservative groundwater condition consisting of thirty (30) feet below ground surface on the west side of the fault and 30 feet above the slide plane east of the fault as shown on Figure 3.

In the flat valley bottom portion of Oak Tree Farm, the uppermost groundwater level is somewhat variable, and is probably controlled by lenticular and discontinuous aquifers. Of 14 borings drilled to groundwater in the flatland area, 13 encountered the first groundwater table at depths ranging between 20 and 38 feet. The one exception (B-16) encountered only silty clay to a depth of 53.5 feet.

TABLE 1 - PIEZOMETER MONITORING DATA

Boring	Drilled Depth (feet)	Piezometer Depth (feet)	Date Piezometer Drilled	Height of Pipe Above Ground Surface (feet)	Water Level Readings Below Top of Piezometer Pipe (feet) 1992										1996	
					4-Jun	17- Jun	22-Jun	23-Jun	24-Jun	6-Jul	7-Jul	21-Sep	28-Sep	7-Oct	1-Nov	6-Nov
41	260	175 260	5/27/92	1.5 1.2	dry 221.9	dry 234	•	•	•	dry	dry 242.29		171 252	dry 249.8	dry 253	•
42	116.5	114	6/11/92	-0.5[3]	•	•	3.69[1]	98.1	106	•	106.03	105	105	105.05	[5]	[5]
47	60	59	6/16/92	-0.5	•	58	•	•	•	•	56.68[2]			dry	[5]	[5]
50	50.5	50	6/24/92	-0.5	•	•	•	•	•	•	dry			dry	[5]	[5]
52	127	64 127	9/18/92	3.8 3.7								54.5 126	48 125	47.5 125	•	37.78 129.76
53	100	52	9/29/92	2.1								40	39	39.3	•	39.95
56	121	120	11/6/96	-0.5												dry

NOTES:
- [1] Water level high due to blockage in pipe at 50 feet. Pipe unblocked on 6/23/92
- [2] Water is muddy. Perhaps piezometer level has not established.
- [3] Top of pipe is below the surface.
- [4] Tip is muddy.
- [5] Piezometer lost or destroyed.
- • Water level not measured

Description of Deep Landslide

The deep ancient landslide underlies all of the hillside portions of Oak Tree Farm and extends upslope as far as the upper one-third of the east flank of Pleasanton Ridge between the 800 foot elevation and the 1300 foot ridge top elevation. This steeper slope section may contain sections of the ancient landslide and appears to be of landslide scarp origin, although it also may be partially derived from fault scarp origins as well. The landslide was found to be 89 feet deep in B-53 at the outer edge of the terrace at the base of this scarp. This area is still far upslope from Oak Tree farm.

Within Oak Tree Farm this ancient landslide is found at similar depths in the deeper exploratory borings (Borings A, 40,41, 48, 54, and 56). The relatively undisturbed sedimentary strata near the base of the landslide as well as some bedding exposures on the Oak Tree Farm hillslope suggest that large portions of the ancient landslide failed by a block glide mechanism. The lithology of the allochthonous blocks as well as underlying bedrock appears to be more of a near shore or locustrine derivation than of terrestrial origin. These strata may represent the "Tps" or "Tmss" units of Dibblee (1980a, b).

The depth of the ancient landslide near its toe was found at 85 and 82.5 feet in Borings A and 40, respectively. This level is about 40 to 50 feet below the elevation of the valley floor. According to Keith Kelson (personal communication, 1996), the rate of alluvium accumulation in the site vicinity is probably greater than 40 feet within the last 40,000 years. Near the area of the proposed lots, the ancient landslide was defined as 80 and 88 feet in Borings 48 and 56 respectively. Towards the south side of the landslide the depth was defined as 106 feet in Borings 41 and 54. The depth in this area was somewhat ambiguous in both drive samples and cores owing to relatively undisturbed nature of the sediments. However, an unambiguous marker was found in B-48 at a depth of 74 feet, where the coring tube ran through a 10 inch redwood log section (Sequoia sempervirens) that was age-dated greater than 40,000 years. These data are documented in our report dated 8 July 1992 (rev. 4 August 1992).

The material in the basal shear zone of the ancient landslide appears to vary in different parts of the landslide. In the toe area the shear plane was found to be a very dark gray seam of rubbery clay between 1/4 to 2 inches thick in Borings A and 40. In the upper part of the Oak Tree Farm property it was a dark blue-green sheared silty clay (B-41 and 54). In the area of the proposed ten lots the base was observed at a layer of sandy gravel and or gravelly sand (B-

48 and 56). In the upslope end of the landslide (off-site) the basal zone was a very dark gray pebbly to gravelly clay (B-42 and 53)

The interpreted cross section 12 - 12 for the deep landslide is shown as Figure 3.

Description of Shallower Landslides

The shallower landslides are difficult to categorize because they probably comprise a continuum with regard to depth and recency of activity. In general, the most recently active landslides are probably the shallowest. Table 2, below, lists the borings in the vicinity of the proposed lots that may have penetrated below some of the shallower landslides. In general, the depths range from about 30 to 40 feet. The base of these landslides in the upslope borings appear to be marked by a transition from light brown pebbly or gravelly silt to harder, darker colored gravel and sand (as in B-5, 6, 15, 17, 47, 48 and 56). In the borings farther downslope (B-16, 49, 50 and 57), the base of shallower landslides seems to be masked by lithologies of weathered bouldery gravels that occur close to the surface. Test Pit 19, located within proposed Lot 11 and near B-16, 50 and 57, exposed such material close to ground surface.

TABLE 2, BORINGS IN "Qlr"

Boring No.	Total Depth	Estimated Depth of "Qlr"
5	71	27 ?
6	40	32
15	50	17 ?
16	40.5	37 ?
17	25	22 ?
47	60	31
48	104	31
49	73	43 ?
50	50.5	46 ?
56	120	38
57	40.5	?

The surface evidence of movement is more easily discernible on the ground in the area of the "Qlao" landslides than in the "Qlr" areas. Upslope from proposed Lot 10, an area with ground surface indicative of rotational slumping has been explored by Test Pits in which landslide shear planes and lithologies have been described (TP-4, 5,6, and 7). Another area in which "Qlao" features occur is a complex of landslides running from above proposed Lot 9 down through Lot 9, Lot 8 and portions of Lots 11 and 12. Features in this area look more like "wrinkles" and are suggestive more of translational movement rather than rotational.

The smallest landslides, some of which are labeled "Qla" and some of which are not labeled, are usually rotational slumps that have occurred within recent decades or are remobilizing almost every winter. The "Qla" landslide mapped in the southwestern corner of Oak Tree Farm occurred in the Winter of 1985-86.

SHEAR STRENGTH OF SLIDE PLANE

As previously mentioned, variable material types exist along the slide plane and the determination of a representative shear strength value would be difficult. In order to assist in selecting a possible range of appropriate strength values, results of laboratory shear strength tests, empirical relationships between index soil properties and strength, and back analysis, will be used.

Laboratory Shear Strength and Index Tests

Shear strength data was obtained from samples collected at the postulated slide plane for both the ancient and more recent slides. In addition, index classification testing was performed. The tests performed consisted of:

a) Direct shear tests run at slow strain rate (0.016 inches/minute);
b) Direct shear tests run at fast strain rate (0.050 inches/minute);
c) Consolidated undrained (CU) triaxial shear tests with pore pressure measurements;
d) At the conclusion of a number of the direct shear tests, Atterberg Limit tests were performed on the sheared material.

Prior to testing, the samples were saturated under the overburden stress levels that exist at the sample depth. The samples were sheared under various conditions in an attempt to model field and loading conditions. For long-term static conditions,the samples were saturated and sheared at a slow strain rate of 0.016 inches/minute. In an attempt to model short-term seismic conditions, a sample was sheared under saturated conditions at a fast rate of 0.05 inches/minute Residual shear tests were performed by repeatedly shearing the sample at a slow strain rate to the maximum travel and then rewinding back to the starting position a number of times until near uniform stress strain plots were achieved. Four to seven cycles were generally needed to achieve this.

The triaxial compression test (CU) consists of confining a soil sample in a membrane and lateral confining pressure is applied. The soil sample is subject to a back pressure while the confining outside pressure is applied and water is allowed, through back pressure, to cause full saturation. The sample is then subjected to a compression load and water drainage out of the sample is prevented. The purpose of preventing water from escaping is to measure the pore pressure in the sample so that total and effective stresses are obtained.

Because of the heterogeneous nature of the highly consolidated slide material and in the absence of a well defined shear or slide plane, the soil samples tested by triaxial methods experienced different modes of failure in the triaxial test. Some failed by bulging, others failed along a localized weak seam within a portion of the sample and the remaining samples failed in shear along a plan of 45° to 60° measured with a horizontal plane perpendicular to the longitudinal axis of the sample. As a result, the classical shear strength envelope defined by a tangent to all three Mohr Circle plots was not obtained. The test data were interpreted,and a total and effective stress envelope was plotted to best suit the data obtained.

The results of the tests are summarized in the following tables for the ancient landslide and for all recent slides. A summary of the results are plotted on Figure 6.

TABLE 3
LABORATORY STRENGTH AND INDEX RESULTS FOR ANCIENT LANDSLIDE

Boring	Depth (ft.)	Material Description	Shear Strength		Atterberg Limits	
			Peak	Residual	Liquid Limit (%)	Plasticity Index
A	30	tan brown silty clay	C = 2100 $\phi = 15°$	C = 0 $\phi = 15°$	81	56
40	82.5	dark gray blue silty clay	C = 2100 $\phi = 21°$	C = 0 $\phi = 26°$	50	32
41	106	dark gray blue silty clay	C = 7800 $\phi = 14°$(1)		56	33
41	107	dark gray blue silty clay	C = 4600 $\phi = 14°$	C = 0 $\phi = 15°$	68	44
42	83.5	dark gray blue silty clay	C = 4000 $\phi = 41°$	C = 0 $\phi = 31°$	61	44

Note: (1)Sheared at fast strain rate

TABLE 4
LABORATORY STRENGTH AND INDEX RESULTS FOR RECENT SLIDES

Boring	Depth (ft.)	Shear Strength		Atterberg Limits	
		Peak	Residual	Liquid Limit (%)	Plasticity Index
8	18.5	C = 2300 $\phi = 38°$			
10	28.0	C = 2900 $\phi = 18°$			
10	33.0	C = 4100 $\phi = 11°$			
11	35.0	C = 1900 $\phi = 21°$		40	17
43	52.5	C = 1300 $\phi = 14°$	C = 0 $\phi = 26°$	47	24
43	53.0	C = 4100 $\phi = 25°$			
44M	15.0	C = 2700 $\phi = 42°$		61	37
45	30.3	C = 2600 $\phi = 43°$	C = 0 $\phi = 13°$	58	35
46	49.7	C = 1000 $\phi = 33°$	C = 0 $\phi = 21°$	40	20
47	30.3	C = 110 $\phi = 42°$		30	11
47	30.8	C = 600 $\phi = 33°$			
48	29.0	C = 800 $\phi = 40°$			
49	42.2	C = 2150 $\phi = 33°$			
49	43.0	C = 2300 $\phi = 24°$		69	44
50	48	C = 6600 $\phi = 15°$ (1)		45	26

Note: (1) Sheared at fast strain rate

Back Analysis

Another approach to provide design strength parameters is to perform a back analysis of the ancient landslide. This approach entails determining likely strength parameters at the time of failure (activation) of the slide.

Back analysis is a good approach to determining strength parameters when the conditions of failure are accurately known in cases such as active landslides. If the conditions at failure are not accurately known or are assumed, then the results are not reliable and should be used for guide purposes only. This slide falls into the latter category for the following reasons:

i) It is virtually impossible to accurately recreate the original landform configuration due to the amount of and complex nature of movement and erosional influences.

ii) Groundwater conditions at the time of failure are unknown and cannot be accurately predicted.

iii) Although it is strongly believed that a seismic event triggered sliding, it is unknown what the magnitude of the seismic event was.

The latter two factors are the ones to which the back analyzed values are the most sensitive. As previously mentioned, it is most likely that the slide was activated by a large seismic event coupled with a high groundwater table.

In spite of the limitations of this approach for this particular slide, we have nevertheless conducted a back analysis for illustrative purposes to mainly obtain an order of magnitude of values.

The pre-landslide landform configuration for section 6-6, as presented in Figure 2a of our August 1992 report, with a groundwater table approximately halfway between the ground surface and the slide plane, represents our best assumption of conditions at failure. Higher groundwater conditions were not considered as this would yield higher strength results. Since

it is believed that the ancient landslide was triggered by a major seismic event, a seismic coefficient of 0.32g (see later) was used in the back analysis.

The analysis was performed by assigning one of the strength parameters (C or ϕ) to zero and calculating the value of the other parameter to achieve a safety factor of unity (1). The relationship between C and ϕ is then plotted to give a unique range of combinations of C and ϕ that represent the slide plane's inherent strength. The actual combination of C and ϕ values would be determined on the basis of empirical data and on data obtained on direct shear test results of the slide plane material.

The results of the back analysis are presented on Figure 7.

For static conditions, an empirical cohesion value of 300 p.s.f. (based on TABLE I, NAVFACDM-7.2, Chapter 2, 1982) was selected as a basis for determining ϕ. From Figure 7 a value of 22° was obtained.

For seismic conditions, an initial empirical ϕ value of 25° was selected to give a resulting cohesion of C =3,000 p.s.f. This value is plotted on Figure 6.

Selection of Design Shear Strength Parameters

Examination of the plot of all shear strength data on Figure 6 reveals a wide scatter of results. The wide scatter is attributed to the heterogeneous nature of the soil, the type of test performed, drainage conditions during testing, the confining pressures applied, and pore pressure measurements.

The relationship between peak and residual angles of internal friction with plasticity index is plotted on Figures 8 and 9, respectively. The relationships show that a general trend consistent with published data is evident.

It is readily apparent that, based on laboratory data and empirical correlations, a lower bound residual strength value of $C = 0$, $\phi = 15°$ results. This value probably represents the strength of the silty clay material under a planar shear surface created during the test. This, however, may not be representative of the actual shear plane of the slide, which will pass through a number of different soil layers of slightly higher strength than the lower bound and is most

likely not planar due to its long length but may have some undulation. It should be noted that the slope stability analysis models the shear plane as one material with one shear strength which, therefore, represents an average value for all materials present along the shear plane. On this basis, the average lower bound range of the residual angle of internal friction for use in the analysis could be of the order of $\phi = 20°$. It is our opinion that the ancient landslide plane does possess some cohesion value because of the relatively high overburden pressures that exist at the slide plane. In addition, due to the age of the landslide, the slide plane would have experienced a high degree of consolidation and healing over time. A cohesion value of 300 p.s.f. would be considered suitable for static conditions.

For the peak strength values an angle of internal friction in the range of 20° to 25° would be appropriate. The selection of a design cohesion intercept is more difficult due to the scatter of results present. Under seismic conditions, loads of very short duration are generated and the soil does not have enough time to respond to the seismic load in the same way as long term static conditions. The sample which was tested under a fast strain rate yielded a cohesion value of 7,800 p.s.f. This value appears excessive but demonstrates that the soil material possesses a higher apparent cohesion under short duration loads. This is consistent with previous work we have performed which indicates the cohesion value from fast strain direct shear tests is generally 1.5 to 2 times the cohesion value from slow strain rate testing for the same material. On the basis of our laboratory data, cohesion values of 2,000, 3,000, and 4,000 p.s.f. will be used.

For the recent slides, the same range of shear strength parameters will be used; however, due to the shallower depth than the large ancient slide, a lower range of cohesion values of 1,000 and 2,000 p.s.f. will be used.

SEISMIC COEFFICIENT

A detailed discussion on the calculation of the seismic coefficient using the methods recommended by Ashford and Sitar (1994) are presented in the accompanying Kleinfelder report. Essentially a seismic coefficient of 0.32g is calculated for an upper level seismic event and 0.18g for a lower level seismic event. Seismic coefficient values of 0.32g and 0.25g will be used in our analysis.

STABILITY ANALYSIS OF LARGE ANCIENT LANDSLIDE

The large ancient landslide was analyzed for slope stability using Cross Section 12-12 and the range of slide strength values and seismic coefficients under the design groundwater table and a deeper ground water condition below the slide. The slope stability program PCSTABL (version 5) was used for our computations.

As previously mentioned, two slide planes, one at 20 feet and another at 40 feet below the toe of the slope, were being evaluated. The deeper slide has slightly higher factors of safety than the shallower one, however, for this report the results of the slope stability of the shallower one are presented as follows:

TABLE 5 - SUMMARY OF ANALYSIS

STRENGTH VALUES		FACTOR OF SAFETY					
		STATIC		SEISMIC			
				0.25g		0.32g	
		Dry	GW	Dry	GW	Dry	GW
C = 0	$\phi = 15°$	1.18	0.99				
C = 0	$\phi = 17.5°$	1.40	1.19				
C = 0	$\phi = 20°$	1.62	1.34				
C = 2000	$\phi = 20°$			1.12	0.97	0.99	0.85
C = 3000	$\phi = 15°$			1.13	1.03	1.0	0.90
C = 3000	$\phi = 20°$			1.32	1.19	1.15	1.04
C = 4000	$\phi = 15°$			1.33	1.23	1.16	1.08
C = 4000	$\phi = 20°$			1.53	1.39	1.33	1.21

The results of the above analysis are presented in graphical form on Figures 10 to 13.

The above analysis indicates that this cross section is more critical than Cross Section 6-6 used in our 1992 work. Variations among different cross sections taken through the large ancient landslide are expected.

DEFORMATION ANALYSIS

A detailed discussion on the use of the finite element deformation analysis is presented in the accompanying Kleinfelder report.

The results of the analysis indicate that under conservative soil and groundwater conditions, a horizontal surface permanent deformation of 10 inches occurs at the westerly end of Lot 9 and decreases to a value of 1 inch at the toe (Lot 5). This shows that the slide does not displace as a block but merely deforms and distorts in shape. It should be noted that the effects of differential movement are of more concern than total movement. Accordingly, the differential horizontal movement across a residence structure would be of the order of 1 inch which is acceptably tolerable.

The street pavement and utility lines should be designed to take into account a total differential movement of 9 inches over 800 feet. This translates into a compressive strain of 0.1 percent.

CONCLUSIONS

Slope stability analyses performed in this current study and that of 1992, both showed that the static and pseudo-static factors of safety are lower and higher than accepted values for the range of interpreted shear strength and groundwater conditions. In evaluating the acceptability or otherwise of the analyses, consideration must be given to the degree of conservatism of the shear strength and groundwater conditions, and confidence in the data obtained to arrive at these conditions.

The large ancient landslide covers a very large area and analysis of different locations of cross sections would yield different results, due to local topographic conditions. This explains the slightly different factors of safety achieved for cross section 6-6 in our 1992 report and cross section 12-12 for this study. It is therefore concluded that significant variations in stability at various locations are not likely.

The laboratory strength data have shown that the lowermost residual strength value is ϕ = 15 degrees, for the highly plastic silty clay material at the slide plane. As mentioned before, different soil materials with higher strength values than the lowest, exist along the slide plane. The drilling and groundwater monitoring has shown that the groundwater table is much deeper than the basal slide plane over the majority of the slide and then becomes shallower and possibly above the slide plane near the toe area. The perched groundwater conditions encountered in some of the borings do not have an effect on the stability of the large ancient landslide. Variations in the regional groundwater as found in the borings are not expected to rise to significant groundwater table heights presented in Figure 3. The use of such a high groundwater table and the lowest shear strength data is conservative.

On the balance of the above information, it is our opinion that the ancient landslide as a whole has an acceptable static of safety.

The finite element deformation analysis calculated permanent displacements at various points along the slope. This allows for a better evaluation of stability than the simplified deformation analysis performed in our previous study in 1992. The deformation analysis indicates that structures and improvements constructed on the slope will experience small but tolerable deformations during the design upper level earthquake event. The utilities should have flexible connections to accommodate the estimated movements and it is expected that the planned road may experience some localized cracking or lurching during the upper level earthquake event

The results of this current study support the conclusions reached by ***TERRASEARCH, inc.***, in 1992, that the large ancient landslide that underlies the Oak Tree Farm property has acceptable levels of stability. The estimated slope deformations during an earthquake event along the Calaveras Fault are relatively small and do not jeopardize the planned residential development and improvements. The risks associated with development on this large ancient landslide are not greater than those associated with a number of planned and existing developments on the east facing slope of the Pleasanton ridge.

GEOTECHNICAL RECOMMENDATIONS FOR LOT DEVELOPMENT

1. A number of smaller, more recent and potentially active landslides exist in the areas of the proposed development. These areas are shown in detail on Figure 4, "Lot Development Plan" for the 10 hillside lots, Lots 5 to 14 and on Figure 2 for Lots 1 to 4.

2. Mitigation for these slides will essentially consist of buttressing by removal of a portion of the slide and replacing as engineered fill. Based on a site reconnaissance, it was considered that the Qlr slides behind Lots 1-4 would require buttressing and the long narrow Qlao landslide (Section 13-13) would require buttressing and a shear key. Other areas of smaller active landslides would require either complete removal buttressing or construction of debris benches/fences at the toe. These are schematically shown on Figure 4. Backslope failures may occur in the excavations during grading. The impact of such failures or variations in the slide geometry will be evaluated in the field.

3. Slope stability analysis on the repaired section 13-13 for the long narrow Qlao slide was performed and the results are as follows:

Strength Values		Factor of Safety					
		Static			Seismic 0.32g		
Slide	Buttress Fill	GW1	GW2	GW3	GW1	GW2	GW3
C = 0 ϕ=15	C=500 ϕ=25° C=1000 ϕ=25°	1.27 1.44	1.36 1.53	1.44 1.61			
C = 0 ϕ=20°	C=500 ϕ=25° C=1000 ϕ=25°	1.49 1.66	1.58 1.75	1.68 1.90			
C=1000 ϕ=15°	C=3000 ϕ=25°				1.10	1.14	1.18
C=1000 ϕ=20°	C=3000 ϕ=25°				1.18	1.22	1.27
C=2000 ϕ=15°	C=3000 ϕ=25°				1.38	1.41	1.45
C=2000 ϕ=20°					1.45	1.50	1.50

4. Groundwater conditions used are:
   GW1 = 15 feet below ground surface
   GW2 = 20 feet below ground surface
   GW3 = 25 feet below ground surface

Detailed stability analyses for the buttressing behind lots 1 to 4 will be performed at a later time. The buttressing shown on Figure 2 is conceptual at this time.

5. The southern sides of Lots 5 to 9 traverse very close to the edge of a steep side scarp of a recent slide. There exists the potential for localized slides or slumps of this area and it is recommended that no structures or improvements be constructed within 30 feet of the top of this feature.

6. Cut slopes for the road or any lot grading that is in excess of 5 feet high needs to be overexcavated for a width of 10 to 15 feet, depending on the height of cut, and recompacted as a buttress fill. cut slopes greater than 10 feet high should be analyzed by a geotechnical engineer.

7. Positive drainage control such as lined ditches should be constructed uphill of cut or fill slopes and building pads. All surface drainage should be collected and discharged into a closed pipe system.

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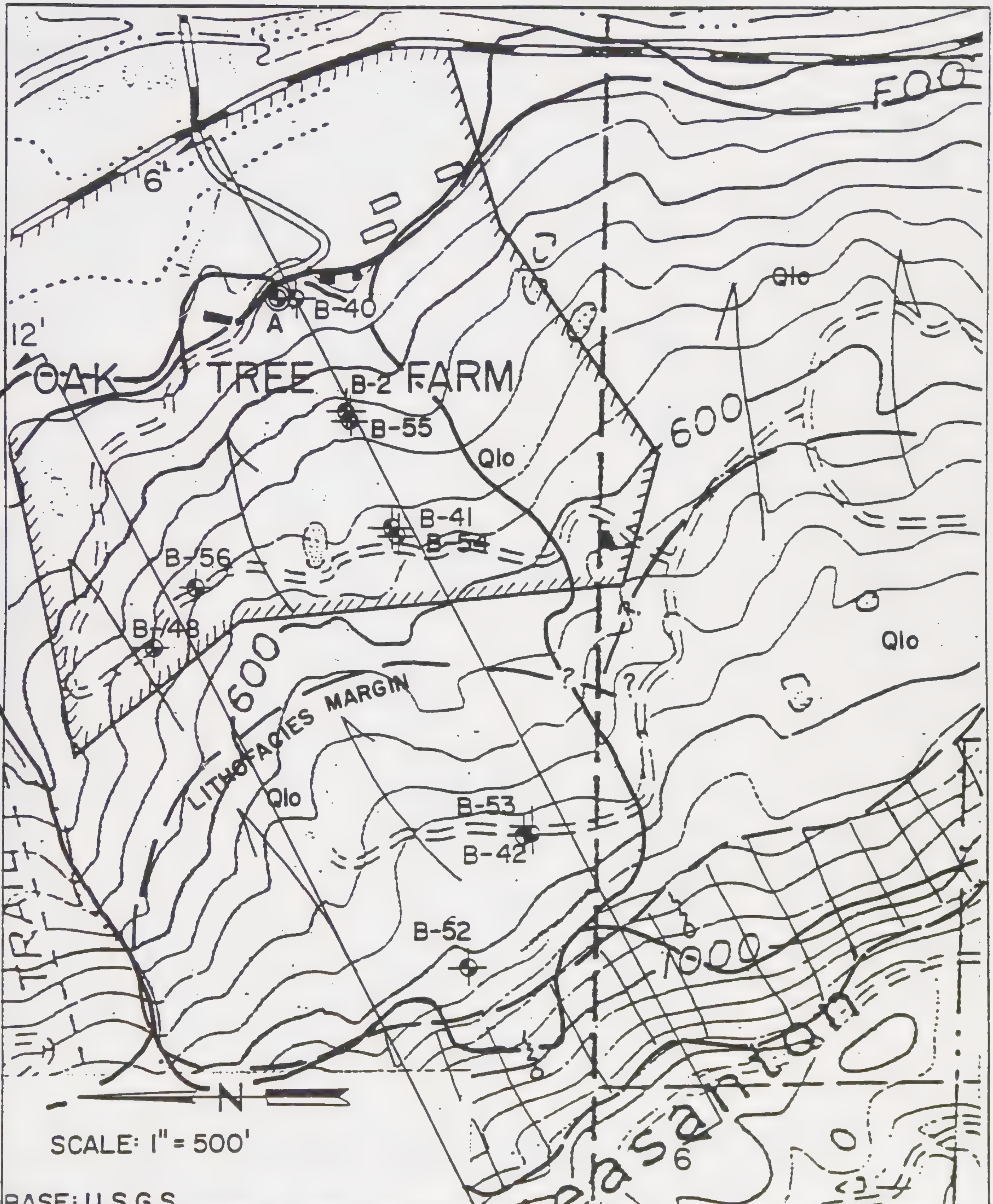
APPENDIX

19 November 1996

Project No. 5541



TERRASEARCH INC. | FIGURE NO. 1 Site Vicinity Map

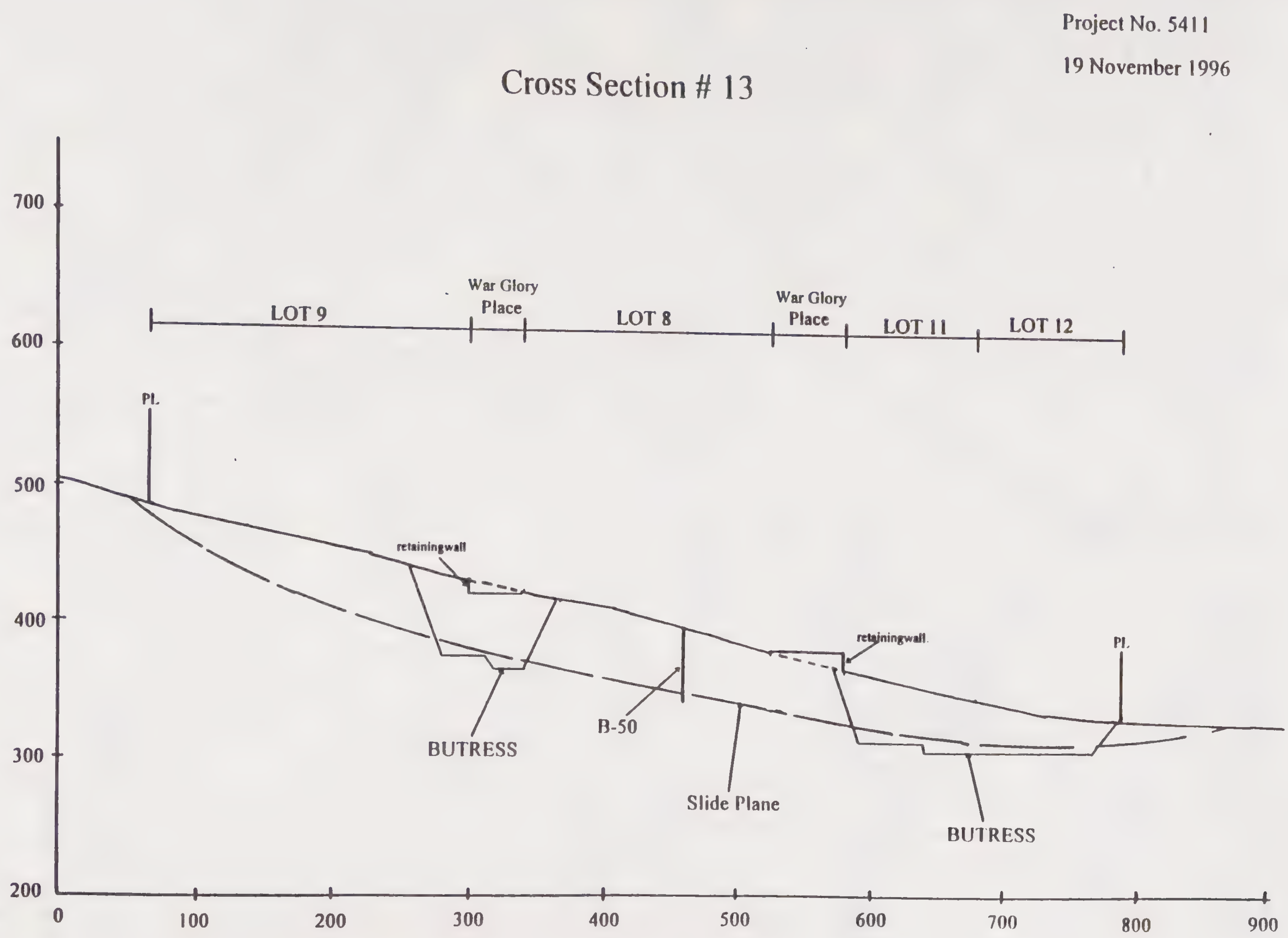


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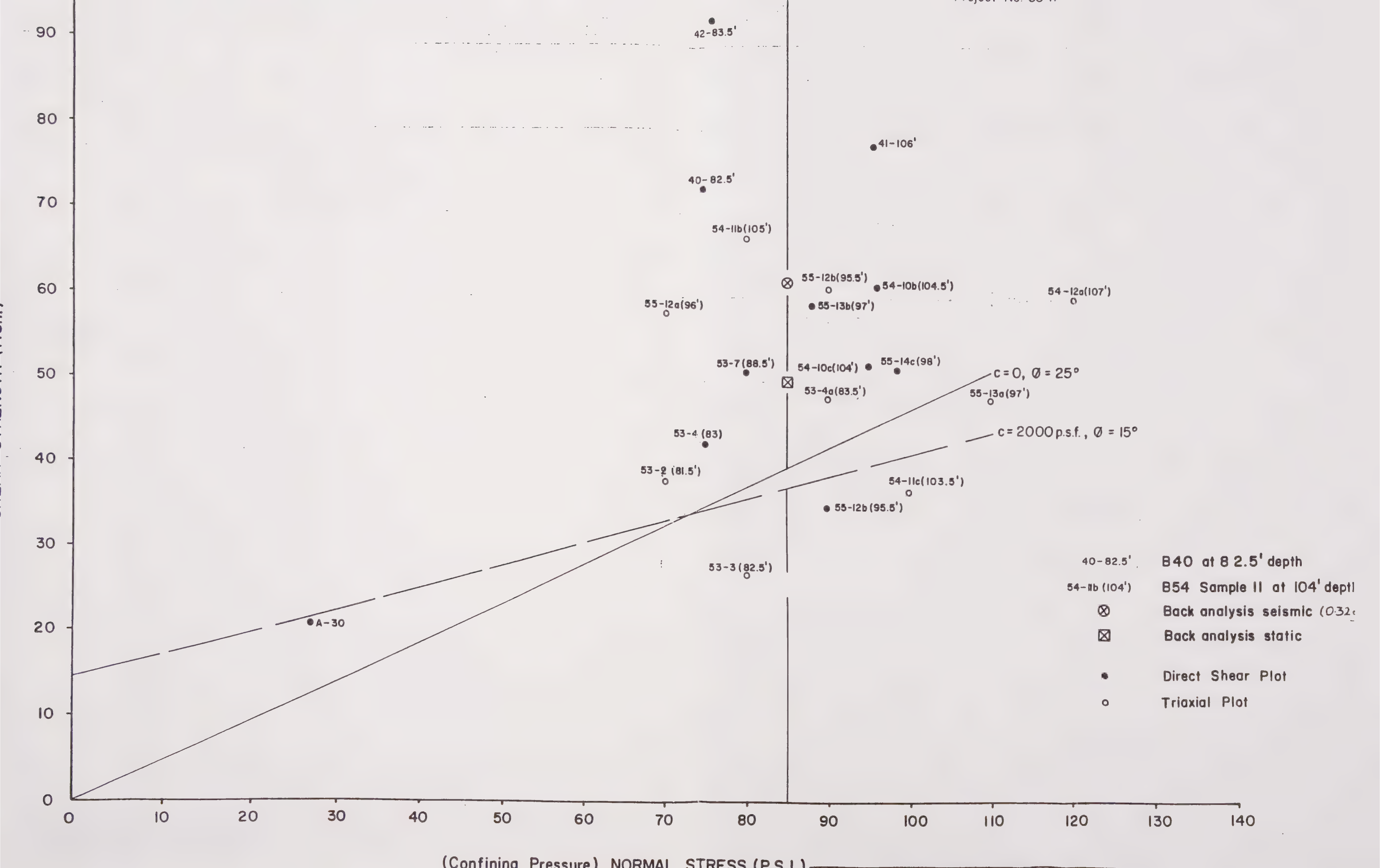
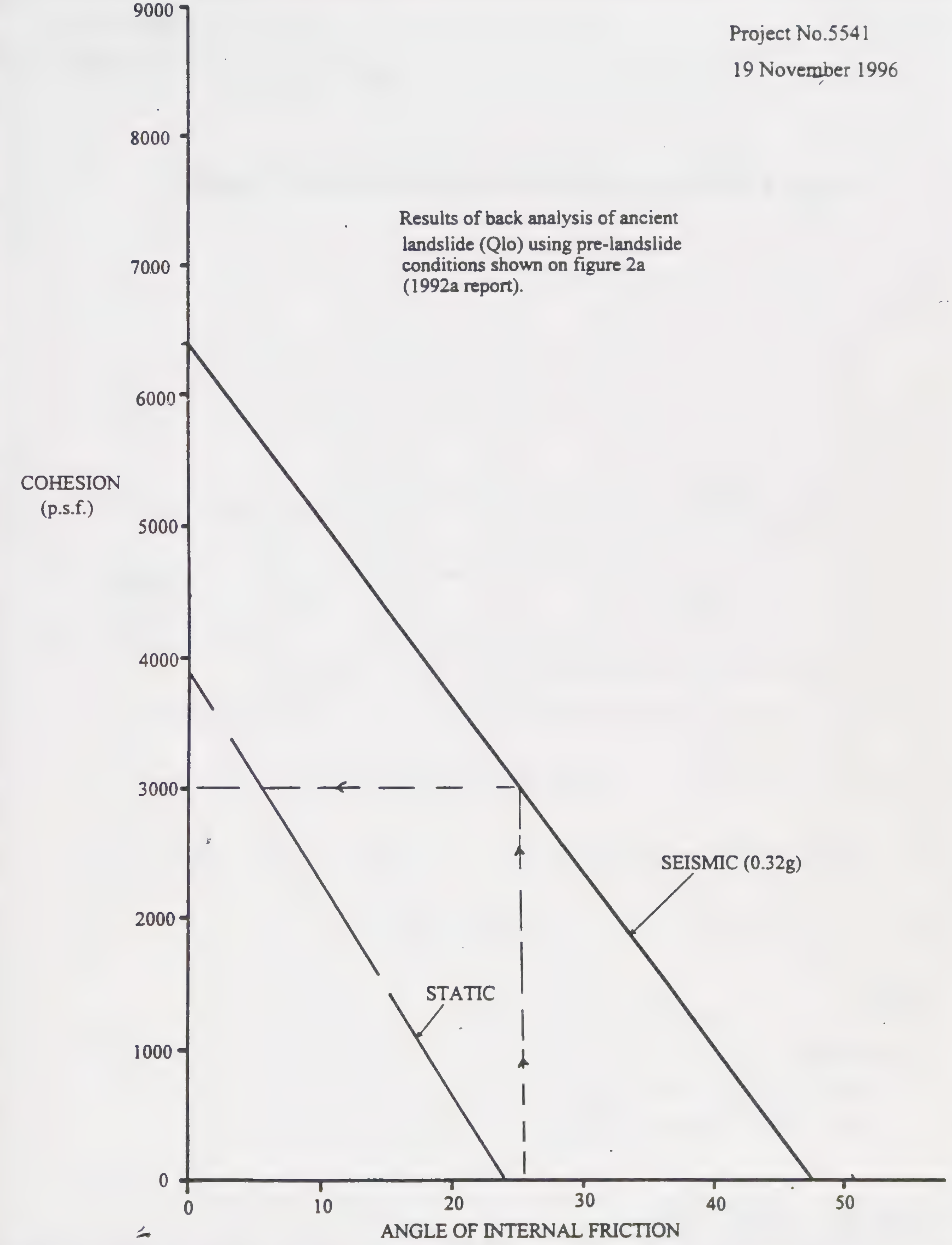
FIGURE NO. 5. Cross Section 13



TERRASEARCH inc

FIGURE NO. 6 Plot of Test Data

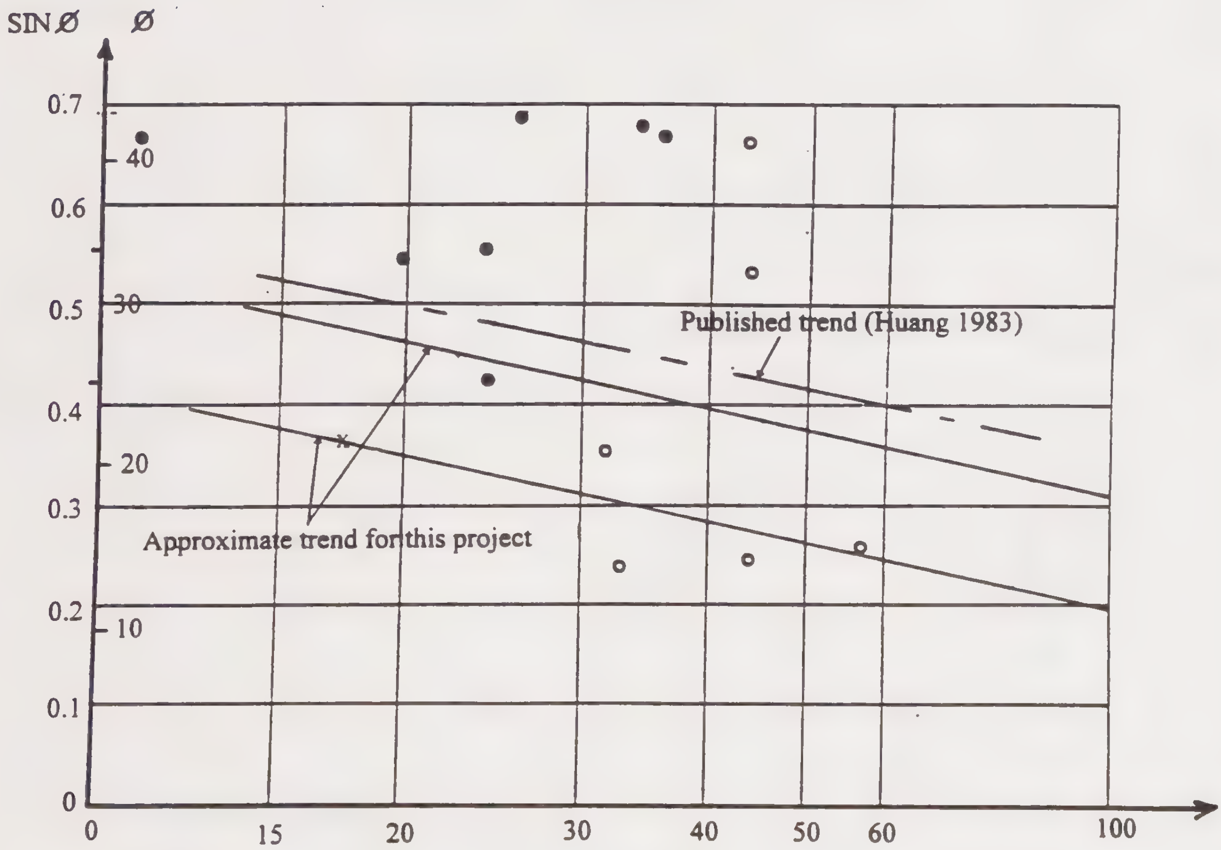


TERRA SEARCH INC.

Figure No.7 BACK ANALYSIS RESULTS

Project No. 5541
19 November 1996

PEAK STRENGTH VS PLASTICITY INDEX



LEGEND

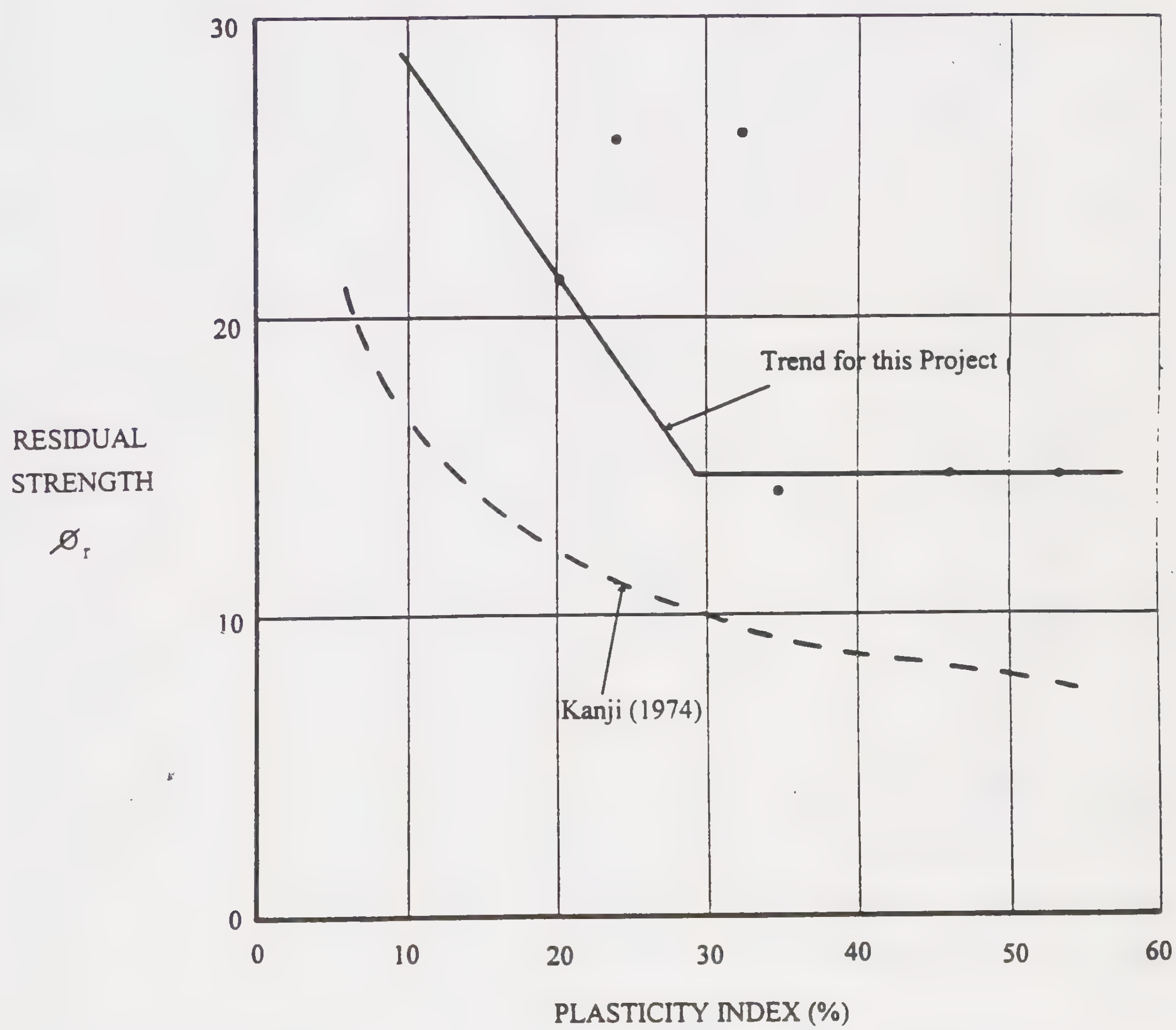
X 1990 Report

o Ancient Landslide Investigation (1992a)

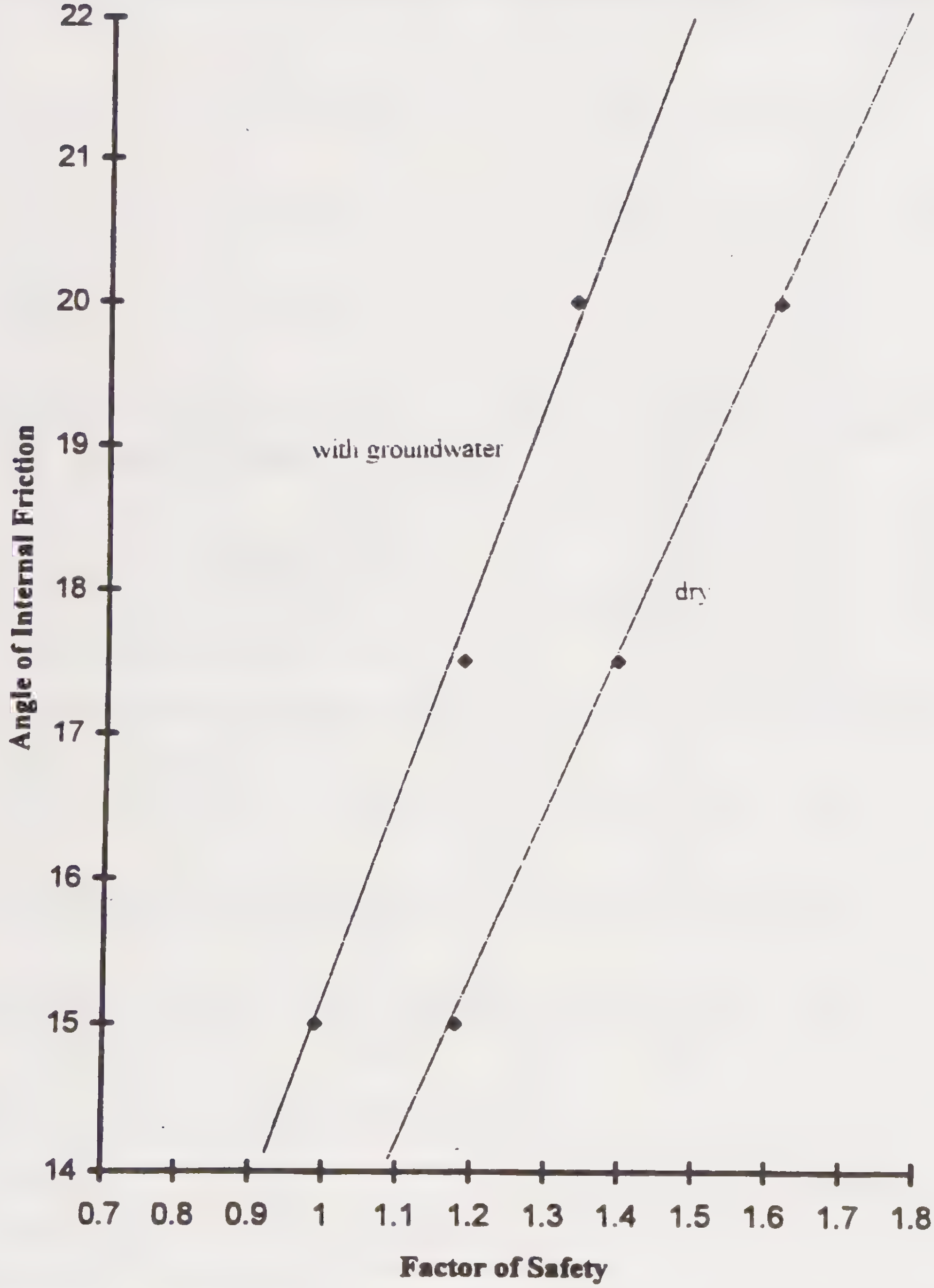
• Recent Landslide Investigation (1992b)

TERRA SEARCH INC. | FIGURE NO. 8

RESIDUAL STRENGTH VS PLASTICITY INDEX

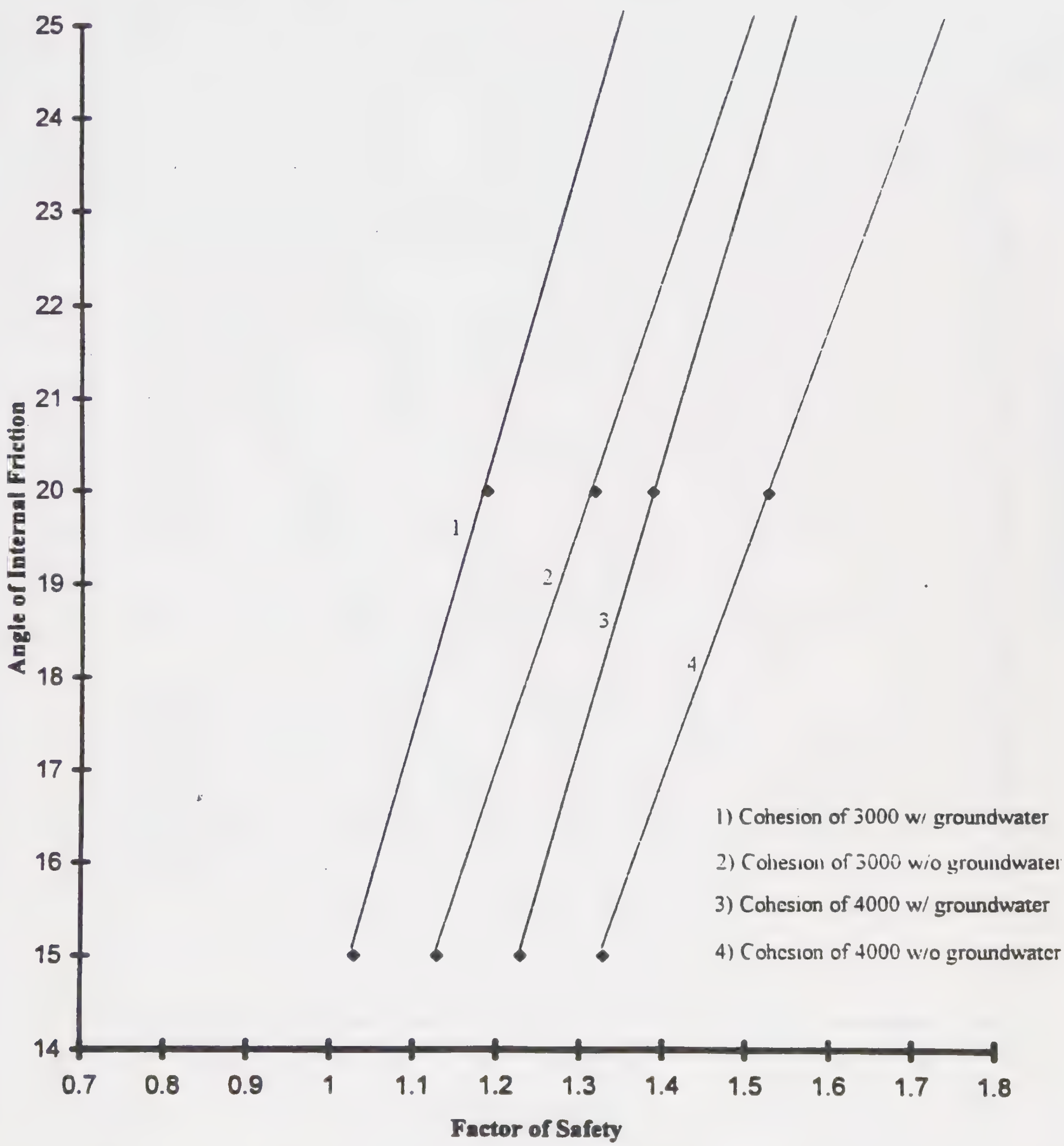


Factor of Safety Vs. Ø
For Dry and Groundwater Conditions
(Static)



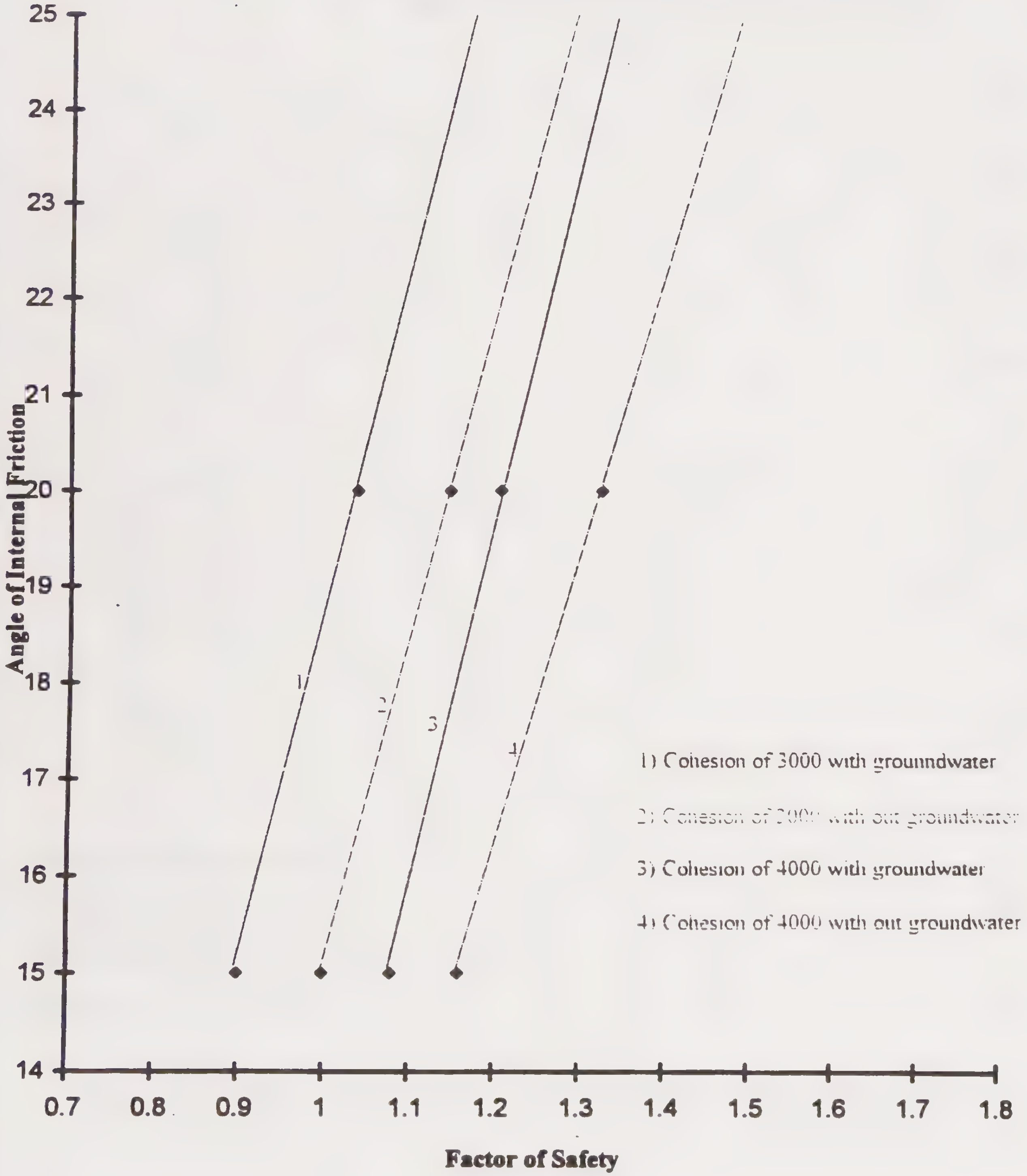
TERRA SEARCH INC.	FIGURE NO. 10

Angle of Internal Friction Vs. Factor of Safety for Seismic = .25g

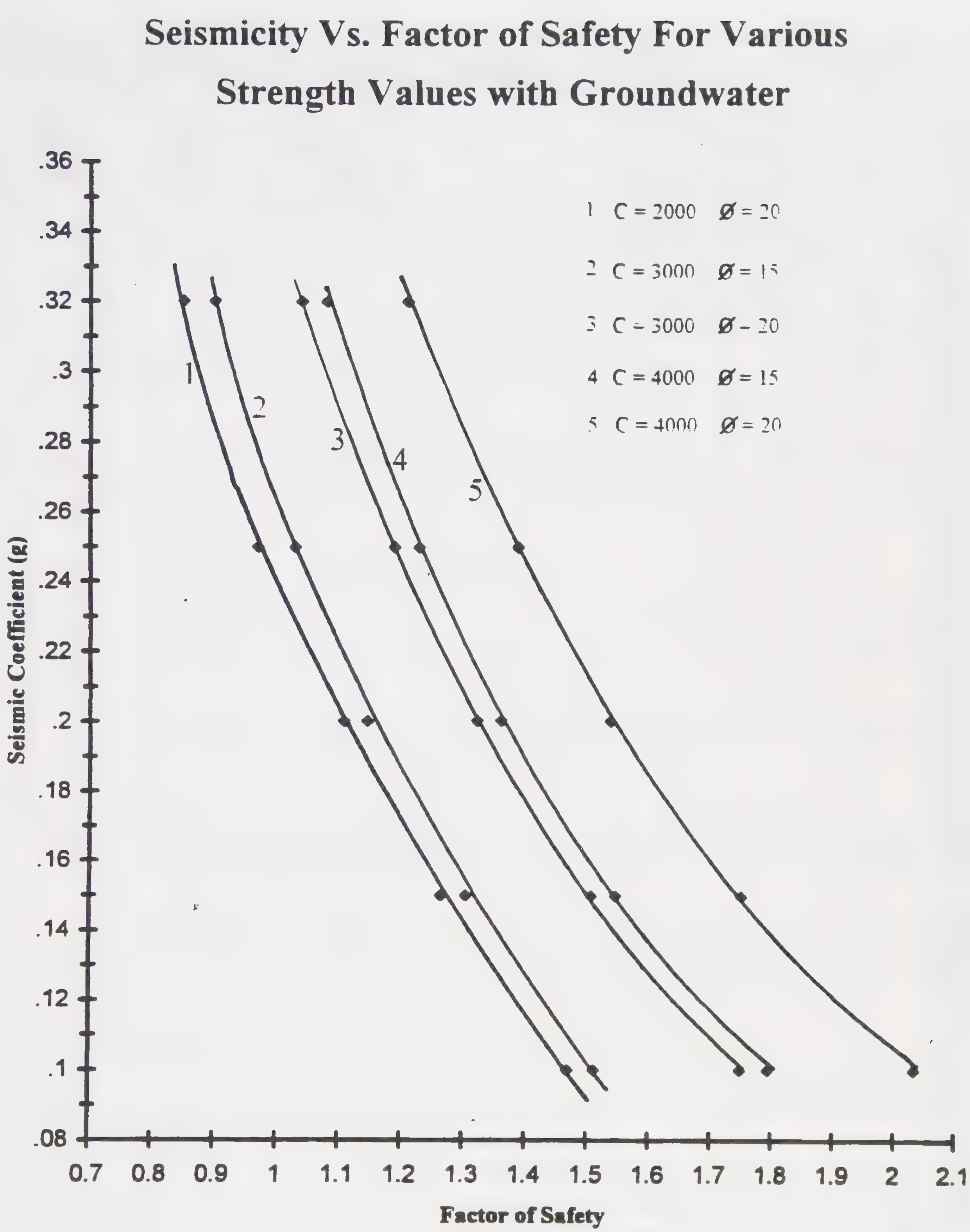


TERRASEARCH INC. | FIGURE NO. 11

Angle of Internal Friction Vs.Factor of Safety for Seismic = .32g



TERRA SEARCH INC.	FIGURE NO. 12



TERRA SEARCH INC.

FIGURE NO. 13

LOGGED BY RR DATE DRILLED 6/12/86 BORING DIAMETER 6" BORING NO. 1

Depth, ft.	Sample No. and type	Symbol	SOIL DESCRIPTION	Unified Soil Classification	Blows/foot 350 ft-lbs.	Qu - t. s. f. Penetrometer	Dry Density p.c.f.	Moisture % dry wt.	MISC. LAB RESULTS
			Dark red-brown Sandy Clayey SILT	ML					
			Medium brown Clayey SILT						
5									
10	1-1		Mottled medium-brown Clayey Gravelly SILT	ML	34				C = 2200 Ø = 48
15									
			Perched water at 18'						
20	1-2		Dark brown Sandy Clayey Gravelly SILT		42		130	9	
25			Harder drilling at 26'						
			Medium/light brown Clayey GRAVEL	GC					
30	1-3		Tan to grey-brown SANDSTONE clasts in matrix of light red-brown Clay)		62		108	20	
35			Medium grey-green Sandy Silty CLAY	CL					
40	1-4		Dark blue-green Clayey Sandy GRAVEL (Slide debris) (brecciated sandstone and siltstone w/scattered well-rounded pebbles	GC	69				C = 1700 Ø = 28
45			Very hard drilling at 43-44'						

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FIGURE NO. - Log of Test Boring

LOGGED BY RR DATE DRILLED 6/12/86 BORING DIAMETER 6" BORING NO. 1 (con't)

Depth, ft.	Sample No. and type	Symbol	SOIL DESCRIPTION	Unified Soil Classification	Blows/foot 350 ft-lbs.	Qu - t. s. f. Penetrometer	Dry Density p.c.f.	Moisture % dry wt.	MISC. LAB RESULTS
	1-5		Dark blue-green Clayey Sandy GRAVEL as above	GC	62		124	12	base of slide
60	1-6		Dark blue-green Pebbly Clayey SILT, coarse blue-grey SANDSTONE in bottom half		70		124	10	
65			Medium firm drilling with clay bit						
70	1-7		Blue-grey Clayey Pebbly SAND or SANDSTONE		100+				C = 950 Ø = 34
			Medium soft drilling with clay bit						
75									
80	1-8 a b		Blue-grey Clayey SILT and Silty CLAY, cuts easily w/knife, massive	Px	100 +		113	18	
85			Medium soft drilling as above						
90	1-9 a b		As above		100+		109	19	
			Hard spot at 94'						
95									
100	1-10		As above		100+		107	21	
			Boring terminated at 101 feet. Dry at time of drilling.						

TERRA SEARCH INC. FIGURE NO. - Log of Test Boring

LOGGED BY PR DATE DRILLED 6/12/86 BORING DIAMETER 6" BORING NO. 2

Depth, ft.	Sample No. and type	Symbol	SOIL DESCRIPTION	Unified Soil Classification	Blows/foot 350 ft-lbs.	Qu - t. s. f. Penetrometer	Dry Density p.c.f.	Moisture % dry wt.	MISC. LAB RESULTS
0			Medium red-brown Gravelly Clayey SILT	ML					
-5									
			Medium red-brown Silty Gravelly CLAY	CL					
10									
			Medium light brown Gravelly Clayey SILT	ML					
15									
			Medium brown Gravelly SAND	SW					
20	2-1		Medium brown Gravelly SAND w/scattered boulders		100+				C = 0 Ø = 56
			Hard drilling 20 to 24'						
25			PROBABLE BASE OF SLIDE AT 25'						
				Rx					
30	2-2		Tan to light grey-brown Silty very fine-grained SAND (or Sandstone?), massive, friable (possible bedrock?)		66		111	19	
35									
40	2-3		Light grey-brown w/tan mottling Clayey SILT		66		112	18	
45									Perched Water at 45'

TERRA SEARCH INC. FIGURE NO. - Log of Test Boring

LOGGED BY RR DATE DRILLED 6/12/86 BORING DIAMETER 6" BORING NO. 2 (con't)

Depth, ft.	Sample No. and type	Symbol	SOIL DESCRIPTION	Unified Soil Classification	Blows/foot 350 ft-lbs.	Qu - t. s. f. Penetrometer	Dry Density p.c.f.	Moisture % dry wt.	MISC. LAB RESULTS
50	2-4		Dense Clayey SILT as above Color change at 51' to blue-grey		100+		105	21	
55									
60	2-5		Blue-grey Clayey SILT; massive w/ widely scattered pebbles		100+		112	17	
65									
70	2-6		As above		100+		114	17	
			Boring terminated at 71 feet. Dry at time of drilling.						

TERRASEARCH INC. FIGURE NO. - Log of Test Boring

LOGGED BY RR DATE DRILLED 6/12/86 BORING DIAMETER 6" BORING NO. 3

Depth, ft.	Sample No. and type	Symbol	SOIL DESCRIPTION	Unified Soil Classification	Blows/foot 350 ft-lbs.	Qu - t. s. f. Penetrometer	Dry Density p.c.f.	Moisture % dry wt.	MISC. LAB RESULTS
0			Red Pebbly Clayey SILT	ML					
10	3-1		As above		40		121	14	
20	3-2		Mottled grey-brown and red-brown Gravelly Clayey SILT		42		114	19	
25			(water at 36', rose to 25' in 1 hour)						
30	3-3		Mottled blue-grey and tan Pebbly Clayey SILT		35		97	31	LL = 55 PI = 35 C = 1500 Ø = 5
			Grades solid blue-grey						
35									
			Dark blue-grey to blue-green Clayey Gravelly SAND	SW					
40	3-4				70		125	13	
45									

TERRASEARCH INC. FIGURE NO. - Log of Test Boring

LOGGED BY RR DATE DRILLED 6/12/86 BORING DIAMETER 6" BORING NO. 3 (con't)

Depth, ft.	Sample No. and type	Symbol	SOIL DESCRIPTION	Unified Soil Classification	Blows/foot 350 ft-lbs.	Qu - t. s. f. Penetrometer	Dry Density p.c.f.	Moisture % dry wt.	MISC. LAB RESULTS
50	3-5		As above	SW	100+		122	14	
55			Dark blue-grey brecciated SILTSTONE w/irregular polished shear fractures	Rx					
60	3-6				100+		105	26	C = 2600 Ø = 17
65			POSSIBLE BASE OF SLIDE ?						
70	3-7		Massive dark blue-grey very fine-grained SAND and SILT	Rx	100+		110	20	
75									
80	3-8		SAND or SANDSTONE (bedrock?), massive, dark blue-grey, locally Pebbly		100+		118	15	
			Boring terminated at 81 feet. Water at 25 feet.						

TERRASEARCH INC.

FIGURE NO. - Log of Test Boring

LOGGED BY RR DATE DRILLED 6/12/86 BORING DIAMETER 6" BORING NO. 4

Depth, ft.	Sample No. and type	Symbol	SOIL DESCRIPTION	Unified Soil Classification	Blows/foot 350 ft-lbs.	Qu - t. s. f. Penetrometer	Dry Density p.c.f.	Moisture % dry wt.	MISC. LAB RESULTS
			Medium brown Pebbly Clayey SILT	ML					
5									
			Light brown Clayey Pebbly SILT	ML					
10	4-1				52		114	15	
15									
			Tan Sandy GRAVEL; hard, dense	GM					
20	4-2				100+				C = 400 Ø = 50
			PROBABLE BASE OF SLIDE AT 25'						
25			Light olive Clayey SILT (ST?), massive, w/red-brown iron-stained fractures	Rx					
30	4-3				66		103	22	
40	4-4		Medium blue-grey to grey-green Clayey SILT (STONE?), massive	Rx	100+		107	20	
45									
			Tan fine-grained SAND; massive w/near vertical red-brown iron-stained laminae (bedding?)						
50	4-5				100+		119	14	
			Boring terminated at 51 feet. Dry at time of drilling.						

TERRA SEARCH INC.

FIGURE NO. ... - Log of Test Boring

LOGGED BY RT DATE DRILLED 12/21/87 BORING DIAMETER 6" BORING NO. 5

Depth, ft.	Sample No. and type	Symbol	SOIL DESCRIPTION	Unified Soil Classification	Blows/foot 350 ft-lbs.	Qu - t. s. f. Penetrometer	Dry Density p.c.f.	Moisture % dry wt.	MISC. LAB RESULTS
			Dark brown Silty CLAY with scattered rock fragments, stiff and moist						
5			Tan to olive Clayey SILT and SILTSTONE irregular oxidation, scattered oxidized and un-oxidized, angular Siltstone rock fragments, stiff and moist, some caliche, core samples are irregularly fractured						
10	5-1 (c)				38				
15			Similar tan and olive Clayey SILT with abundant angular Siltstone rock fragments very stiff and dry, abundant Caliche in irregular stringers						
20	5-2 (c)		Tan and olive SILT with faint laminations oxidation along fractures		92				
25									
			Dark brown Silty CLAY with scattered angular rock fragments, very dry and hard						
30	5-3 (c)		GRAVEL subangular to subrounded, less than 5mm to 3cm pebbles in dark brown Silty matrix, rock fragments are Franciscan igneous and sedimentary rocks, very dry and stiff		100+				
35			GRAVEL, Franciscan chert and gabbro pebbles ranging from 1cm to 4cm with minor Silty matirx, pebbles subrounded to well rounded, very dry (slide debris?)						
40			Dark brown Silty CLAY with scattered, angular rock fragments, streaks of blue/green Clay throughout, very stiff and moist						

TERRASEARCH INC.

FIGURE NO. - LOG OF TEST BORING

LOGGED BY RT DATE DRILLED 12/21/87 BORING DIAMETER 6" BORING NO. 5" (cont)

Depth, ft.	Sample No. and type	Symbol	SOIL DESCRIPTION	Unified Soil Classification	Blows/foot 350 ft-lbs.	Qu - t.s.f. Penetrometer	Dry Density p.c.f.	Moisture % dry wt.	MISC. LAB RESULTS
			Increasing blue/green color to the CLAY, still contains scattered angular Franciscan rock fragments, very stiff and mosit						
45			Brown Silty CLAY with scattered, angular rock fragments, very stiff and moist, many of the rock fragments are oxidized, some blue/green irregular stringers and pods mixed with brown Silty CLAY (slide debris?)						
50			Blue/green Silty CLAY and CLAYSTONE, harder at 51 feet, no rock fragments, stiff and moist (probable bedrock at 51 feet)						
55			(Tertiary CLAYSTONE and SILTSTONE)						
60			no change Blue/green Silty CLAYSTONE, much harder at 61 feet, very stiff and moist, occasional patches brown CLAYSTONE						
65			(Tertiary bedrock)						
			Blue/green Silty CLAYSTONE with an occasional indurated Franciscan? rock fragment, most of the rock fragments are pebble size (1-2cm) and are well rounded						
70									
			Boring terminated at 71 feet, (refusal). Dry at time of drilling.						

TERRASEARCH INC. FIGURE NO. - Log of Test Boring

LOGGED BY RT DATE DRILLED 12/21/87 BORING DIAMETER 6" BORING NO. 6

Depth, ft.	Sample No. and type	Symbol	SOIL DESCRIPTION	Unified Soil Classification	Blows/foot 350 ft-lbs.	Qu - t. s. f. Penetrometer	Dry Density p.c.f.	Moisture % dry wt.	MISC. LAB RESULTS
			Brown Clayey SILT with scattered oxidized and unoxidized Siltstone rock fragments, stiff, moist						
5			Tan Clayey SILT with scattered angular rock fragments, rock fragments are composed of Sandstone						
10			Tan SILT with faint laminations. Dark green color on a fresh surface, oxidized along fractures or joints, very hard, dry						
15									
20			No change, tan (weathered surface) or dark green/grey (fresh surface) SILT, very hard, dry, oxidation common along fractures or joints						
25									
30									
35			Light brown to tan SILTSTONE with abundant, subangular to subrounded rock fragments, very hard, dry, abundant Caliche becomes oxidized at 35 feet						
40			Boring terminated @ 40 feet (Refusal). Dry at time of drilling.						

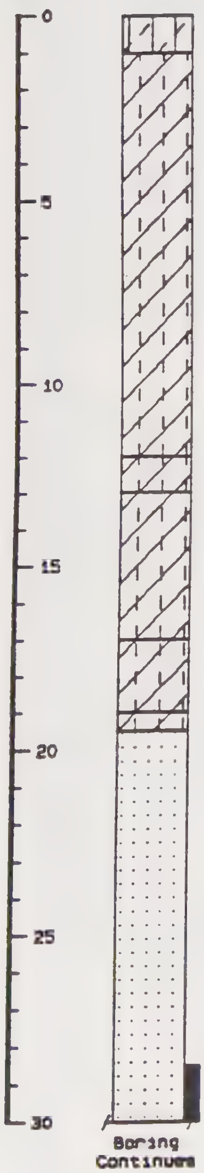
TERRASEARCH INC. FIGURE NO. - Log of Test Boring

LOG OF TEST BORING

BORING 7

Boring No: 7 Project No: 5541
Date Drilled: 10/29/90
Elevation: N/A
Logged by: R.R

Water Level: N/A After: N/A



ELEV / DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS	USCS	SOIL DESCRIPTION	REMARKS	Sample No.	Blows foot	Density Dry-pcf	Moisture Percent
		ML	Light brown Pebbly Clayey SILT (TOPSOIL)					
		CL	Mottled medium brown Pebbly Silty CLAY, firm w/scatter cobbles (SLIDE DEBRIS)					
			Soft snears @ 12' around 2" pebble					
			Low angle 10 degree shear dipping south					
			Shear 10 degree south/south-east					
			Slickensided snear at 19'.					
			Red brown sandy zone with well rounded cobbles at 19.3'-20'. Drilled gap from 21' to 23.5'. No recovery from 23.5 ' to 28.5'.					
					7-1	56		

Figure Number

TERRASEARCH, Inc.

LOG OF TEST BORING

BORING 7

(CORE HOLE)

Boring No: 7
Date Drilled: 10/29/90
Elevation: N/A
Logged by: R.R

Project No: 5541

Water Level: N/A

After: N/A

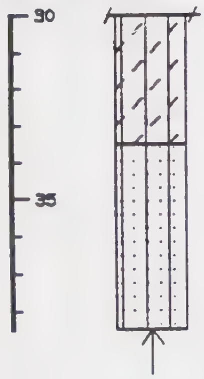
ELEV / DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS	USCS	SOIL DESCRIPTION	REMARKS	Sample No.	Blows foot	Density Dry-pcf	Moisture Percent
30		ML	Light olive drab with red brown laminae Sandy Clayey SILT (QT1). firm. moist.					
35		ML	Interbedded light olive brown SAND and SILT with minor olive green Clay (QTL). (Bedrock)					
			Core terminated at 38.5'. No groundwater encountered.					

Figure Number

TERRASEARCH, Inc.

LOG OF TEST BORING

BORING 8

Boring No: 8 — Project No: 5541

Date Drilled: 10/29/90

Elevation: N/A (Located 2' downslope from B-7)

Logged by: R.R

Water Level: N/A — After: N/A

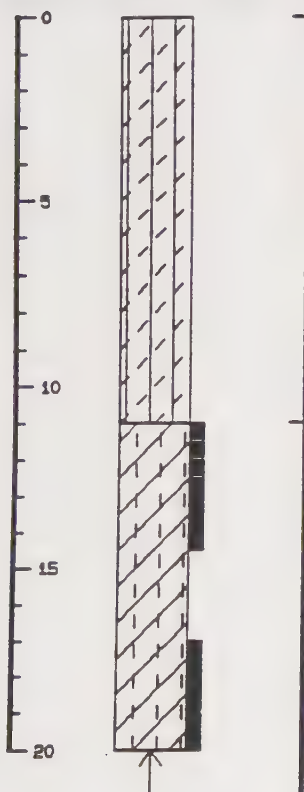
ELEV / DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS	USCS	SOIL DESCRIPTION	REMARKS	Sample No.	Blows foot	Density Dry-pcf	Moisture Percent
0		ML	Medium brown pebbly Clayey SILT					
		CL	Mottled medium brown pebbly Silty CLAY	C=2400 psf Ø=27	8-1a	22	114	11
					8-1b		113	21
					8-2b	40		
					8-2a			
					8-3	46	122	12
			Grades reddish brown		8-4b	23		
					8-4a		119	14
					8-5	30	119	14
					8-6	48	113	17
20			Boring terminated at 20'. No groundwater encountered.	C=2300 psf Ø=38				

Figure Number

TERRASEARCH, Inc.

LOG OF TEST BORING

BORING 9

(CORE HOLE)

Boring No: 9

Date Drilled: 10/29&30

Elevation: N/A

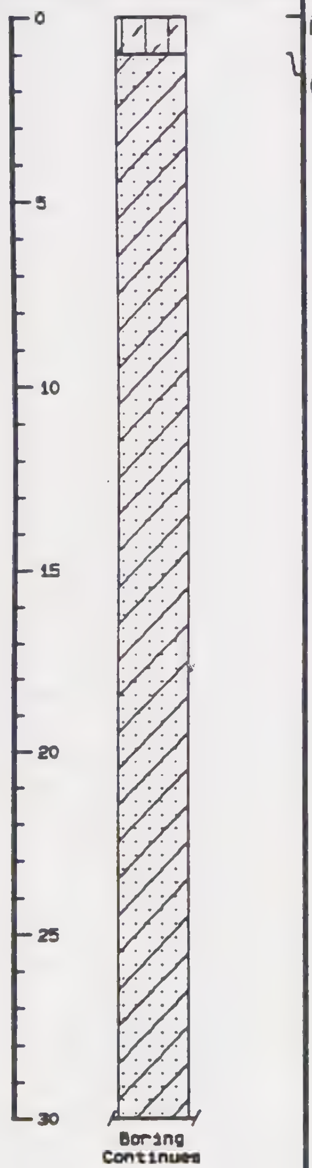
Logged by: R.R

Project No: 5541

Water Level: N/A

After: N/A

ELEV / DEPTH	SOIL SYMBOLS / SAMPLER SYMBOLS



USCS	SOIL DESCRIPTION	REMARKS	Sample No.	Blows foot	Density Dry-pcf	Moisture Percent
ML	Light brown Pebbly Clayey SILT, dry, loose (TOPSOIL)					
CL	Mottled tan/red brown/olive drab Pebbly Sandy Silty CLAY, slightly moist, firm to stiff, scattered cobbles					
	30 degree slickensided shear at 8'					
	Steeply dipping slickensided shear					
	Red-brown zone					
	As above					
	As above, but more pebbles and cobbles					

Figure Number

TERRASEARCH, Inc.

LOG OF TEST BORING

BORING 9

Boring No: 9
Date Drilled: 10/29&30
Elevation: N/A
Logged by: R.R

Project No: 5541

Water Level: N/A

After: N/A

ELEV / DEPTH	SOIL SYMBOLS / SAMPLER SYMBOLS	USCS	SOIL DESCRIPTION	REMARKS	Sample No.	Blows foot	Density Dry-pcf	Moisture Percent
			As above					
			Non-sheared contact					
		SW	Mottled or interlayered tan to red brown SAND w/Gravelly layer at base					
		CL	3" Sandy Gravelly CLAY and Clayey GRAVEL at refusal (Refusal to coring @ 37') Drilled 37 to 59'		9-1	77		
			Gravel in shoe of attempted core @ 40'					
		GW	Mottled light tan Sandy GRAVEL		9-2	92		
			Mottled light tan/light grey/red brown Clayey Sandy GRAVEL; dense, hard drilling		9-3	77	116	9
			As above		9-4	92		
			As above		9-5	92		
			Boring terminated at 59 ft No groundwater encountered					

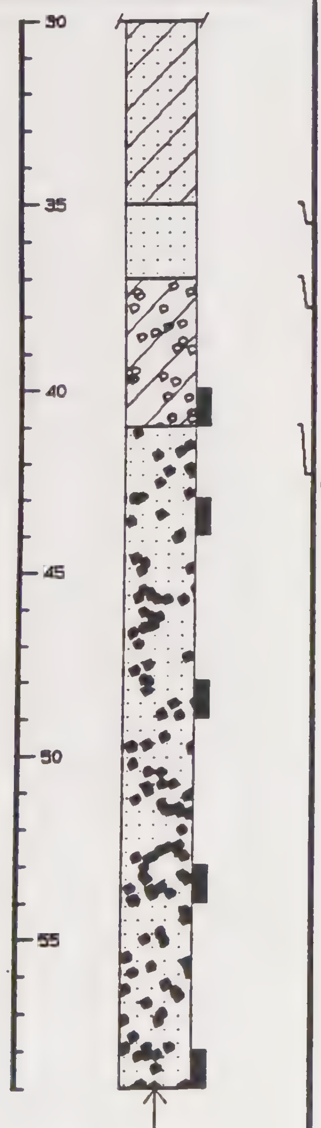


Figure Number

TERRASEARCH, Inc.

LOG OF TEST BORING

BORING 9

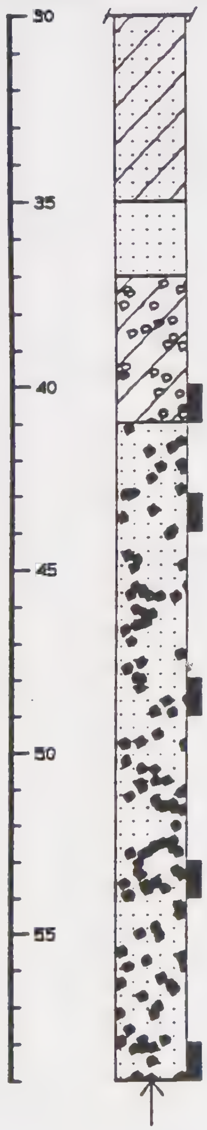
Boring No: 9 — Project No: 5541

Date Drilled: 10/29&30

Elevation: N/A

Logged by: R.R

Water Level: N/A — After: N/A



ELEV / DEPTH	USCS	SOIL DESCRIPTION	REMARKS	Sample No.	Blows foot	Density Dry-pcf	Moisture Percent
		As above					
		Non-sheared contact					
	SW	Mottled or interlayered tan to red brown SAND w/Gravelly layer at base					
	CL	3" Sandy Gravelly CLAY and Clayey GRAVEL at refusal (Refusal to coring @ 37') Drilled 37 to 59'		9-1	77		
		Gravel in shoe of attempted core @ 40'					
	GW	Mottled light tan Sandy GRAVEL		9-2	92		
		Mottled light tan/light grey/red brown Clayey Sandy GRAVEL; dense, hard drilling		9-3	77	116	9
		As above		9-4	92		
		As above		9-5	92		
		Core terminated at 59 ft No groundwater encountered					

Figure Number --

TERRASEARCH, Inc.

LOG OF TEST BORING

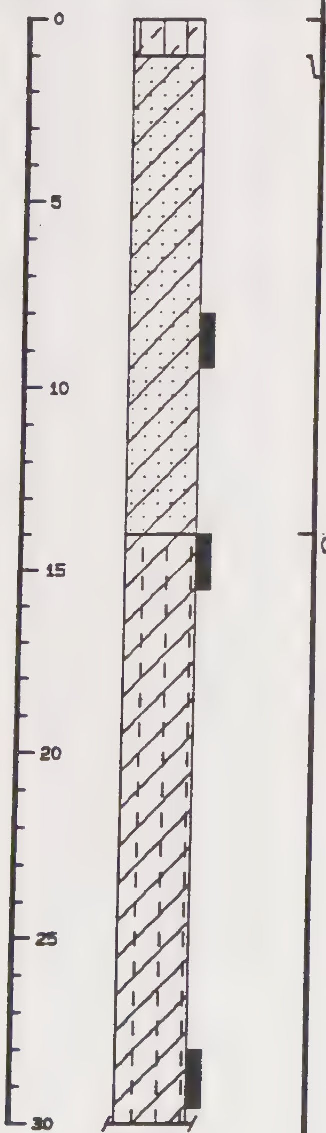
BORING 10

Boring No: 10
Date Drilled: 10/29&30
Elevation: N/A (Located 2' downslope from B-9)
Logged by: R.R

Project No: 5541

Water Level: N/A

After: N/A

ELEV / DEPTH	SOIL SYMBOLS / SAMPLER SYMBOLS	USCS	SOIL DESCRIPTION	REMARKS	Sample No.	Blows foot	Density Dry-pcf	Moisture Percent
		ML	Light brown Clayey Pebbly SILT, dry, loose					
		CL	Mottled light/medium brown Gravelly Sandy CLAY, slightly moist, dense		10-1a 10-1b	38	120	12
		CL	Mottled medium brown pebbly Silty CLAY, moist, stiff		10-2b 10-2a	44	120	15
			Red brown Pebbly Silty CLAY, angular clasts dark grey CLAYSTONE in Clay matrix (SLIDE DEBRIS)	C=2900 psf Ø=18	10-3b 10-3a	37	111	21

Boring Continues

Figure Number

TERRASEARCH, Inc.

LOG OF TEST BORING

BORING 10

Boring No: 10 Project No: 5541
Date Drilled: 10/29&30
Elevation: N/A
Logged by: R.R

Water Level: N/A After: N/A

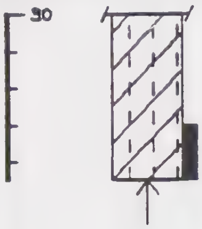
ELEV / DEPTH	SOIL SYMBOLS / SAMPLER SYMBOLS	USCS	SOIL DESCRIPTION	REMARKS	Sample No.	Blows foot	Density Dry-pcf	Moisture Percent
30								
			As above, more Pebbly		10-4b	44		
				C=4100 p.s.f.,	10-4a		115	22
			Boring terminated at 34.5 ft No groundwater encountered	Ø=11deg				

Figure Number

TERRASEARCH, Inc.

LOG OF TEST BORING

BORING 11

(CORE HOLE)

Boring No: 11

Project No: 5541

Date Drilled: 10/30/90

Elevation: N/A

Logged by: R.R

Water Level: N/A

After: N/A

ELEV / DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS	USCS	SOIL DESCRIPTION	REMARKS	Sample No.	Blows foot	Density Dry-pcf	Moisture Percent
		ML	Light brown Pebbly Clayey SILT					
		CL	Mottled dark grey brown Pebbly Silty CLAY					
		ML	Mottled red-brown Pebbly to Gravelly CLAY and Clayey Pebbly Sandy SILT (Drilled 7-8') Incomplete recovery due to cobbles (8-13') Refusal to coring @ 13' Drilling Gravel 13-18'					
					11-1	22	116	15
			Slickensided grey Clayey shear zone @ 20' Sandy red brown zone @ 22'					
		CL	Mottled dark brown Pebbly to Gravelly CLAY w/minor red brown and/or Sandy zones (SLIDE DEBRIS)					

Coring refusal at 48.5 feet due to sand bunching up in core barrel.

Figure Number

TERRASEARCH, Inc.

LOG OF TEST BORING

BORING 11

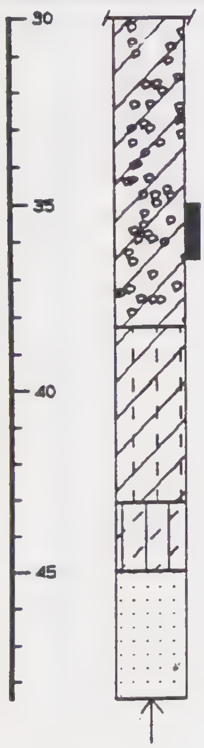
Boring No: 11 — Project No: 5541

Date Drilled: 10/30/90

Elevation: N/A

Logged by: R.R

Water Level: N/A — After: N/A



ELEV / DEPTH	SOIL SYMBOLS / SAMPLER SYMBOLS	USCS	SOIL DESCRIPTION	REMARKS	Sample No.	Blows foot	Density Dry-pcf	Moisture Percent
30			As above					
35			Coring refusal at 35'; drilled 35'-37' Sandy Cobbly zone Pebbly to Gravelly CLAY Mottled light red brown to khaki Pebbly CLAY	LL=40 PI=17 C=1900 psf Ø=21	11-2	14	107	22
40		CL	Mottled blue green Silty CLAY w/caliche blebs, soft, moist, massive (QTl bedrock)					
			Gradational change at 43'					
45		ML	Blue grey or grey blue Clayey SILT grading to very fine SAND @ 45'					
			Blue grey/grey blue SAND, very fine grained, moist, massive					
			Core terminated at 48.5 ft No groundwater encountered					

Coring refusal at 48.5 feet due to sand bunching up in core barrel.

Figure Number :

TERRASEARCH, Inc.

LOG OF TEST BORING

BORING 12

Boring No: 12 　　　　　　　　　　　　Project No: 5541

Date Drilled: 11/1/90

Elevation: N/A (Located 2' downslope from B-11)

Logged by: R.R

Water Level: N/A 　　　　　　　　　　After: N/A

ELEV / DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS	USCS	SOIL DESCRIPTION	REMARKS	Sample No.	Blows foot	Density Dry-pcf	Moisture Percent
0		ML	Light brown Clayey SILT					
		CL	Medium brown Pebbly Silty CLAY					
15			Medium/dark grey brown color					
20		CL	Medium red brown Pebbly CLAY		12-1b	25		
					12-1a		120	13

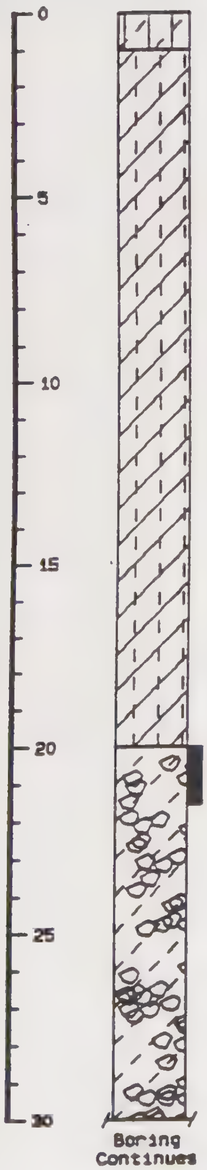


Figure Number

TERRASEARCH, Inc.

LOG OF TEST BORING

BORING 12

Boring No: 12 — Project No: 5541

Date Drilled: 11/1/90

Elevation: N/A

Logged by: R.R

Water Level: N/A — After: N/A

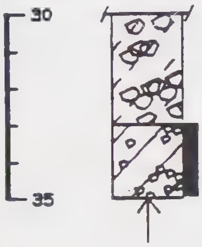
ELEV / DEPTH	SOIL SYMBOLS / SAMPLER SYMBOLS	USCS	SOIL DESCRIPTION	REMARKS	Sample No.	Blows foot	Density Dry-pcf	Moisture Percent
30 – 35		CL	Pebbly to Gravelly CLAY w/ Cobbles. Sandstone cobble in shoe		12-2b 12-2a 12-3	33 92	 103	 19
			Boring terminated at 35 ft No groundwater encountered					

Figure Number :

TERRASEARCH, Inc.

LOG OF TEST BORING

BORING 13

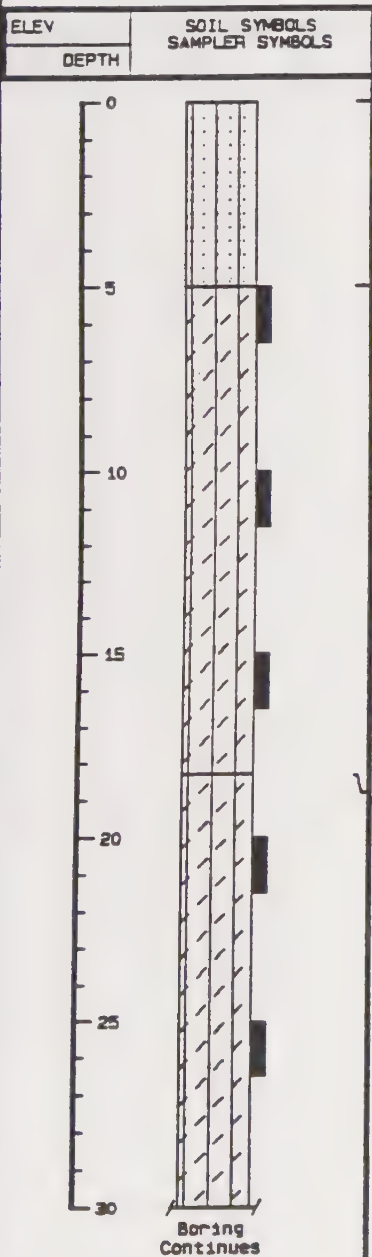
Boring No: 13 | Project No: 5541

Date Drilled: 11/1/90

Elevation: N/A

Logged by: R.R

Water Level: N/A | After: N/A



USCS	SOIL DESCRIPTION	REMARKS	Sample No.	Blows /foot	Density Dry-pcf	Moisture Percent
ML	Light red brown Sandy Pebbly SILT					
ML	Tan Pebbly to Gravelly Clayey SILT, dry to slightly moist, firm, dense		13-1	35	122	7
	Mottled tan to red brown Clayey SILT		13-2	28	108	14
	As above but Pebbly to Gravelly	LL=45 PI=16	13-3	54	118	10
	PROBABLE BASE OF SLIDE					
ML	Light khaki Clayey SILT, massive, slightly moist (QTl bedrock)		13-4	36	110	20
	Grey-brown Clayey SILT w/ scattered pebbles and cobbles		13-5	25		

Figure Number

TERRASEARCH, Inc.

LOG OF TEST BORING

BORING 13

Boring No: 13 | Project No: 5541

Date Drilled: 11/1/90

Elevation: N/A

Logged by: R.R

Water Level: N/A | After: N/A

ELEV / DEPTH	SOIL SYMBOLS / SAMPLER SYMBOLS	USCS	SOIL DESCRIPTION	REMARKS	Sample No.	Blows foot	Density Dry-pcf	Moisture Percent
30			As above w/steeply dipping joint, rare well rounded pebbles to 2" diameter		13-6	51		
			Boring terminated at 31.5 ft No groundwater encountered					

Figure Number

TERRASEARCH, Inc.

LOG OF TEST BORING

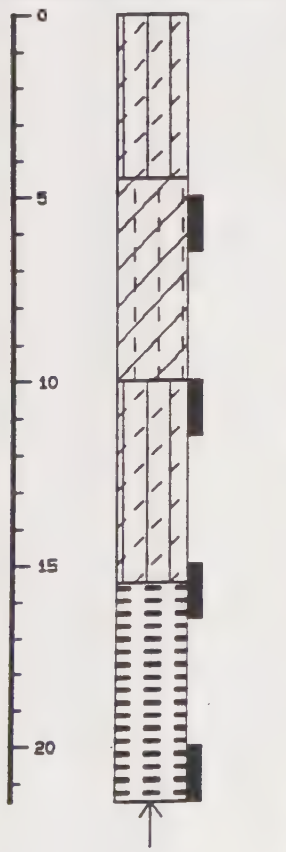
BORING 14

Boring No: 14
Date Drilled: 11/1/90
Elevation: N/A
Logged by: R.R

Project No: 5541

Water Level: N/A

After: N/A



ELEV / DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS	USCS	SOIL DESCRIPTION	REMARKS	Sample No.	Blows foot	Density Dry-pcf	Moisture Percent
0		ML	Dark brown Pebbly Clayey SILT					
5		CL	Red brown Pebbly Silty CLAY, dense, stiff, slightly moist		14-1	26		
10		ML	Mottled tan/red brown Gravelly Clayey SILT and Sandy Clayey GRAVEL		14-2	35	122	9
15			Mottled tan/light grey fine grained SANDSTONE w/small whitish fragments (shell fragments?), hard, massive (QT1)		14-3	67		
20			Mottled tan/red brown coarse granular SANDSTONE w/some small pebbles, looser than above		14-4	38		
			Boring terminated at 21.5 ft. No groundwater encountered					

Figure Number

TERRASEARCH, Inc.

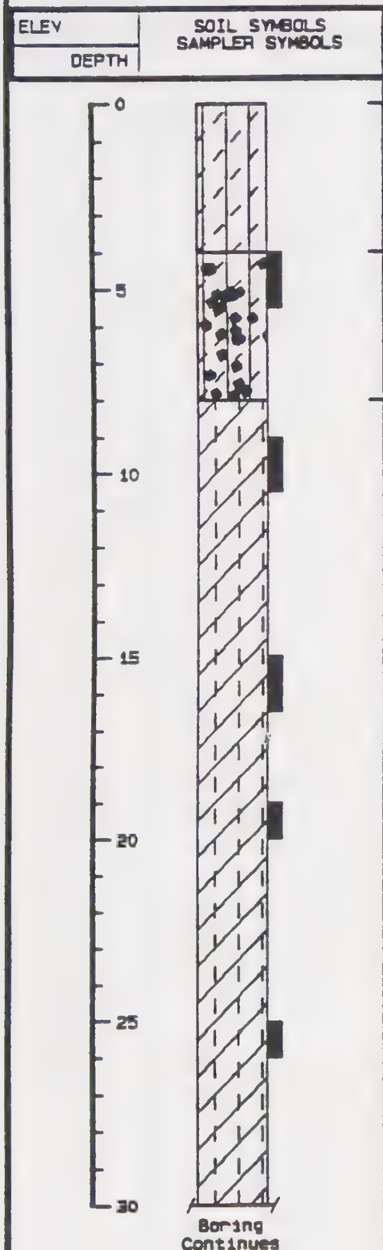
LOG OF TEST BORING

BORING 15

Boring No: 15
Date Drilled: 11/2/90
Elevation: N/A
Logged by: R.R

Project No: 5541

Water Level: N/A   After: N/A



USCS	SOIL DESCRIPTION	REMARKS	Sample No.	Blows foot	Density Dry-pcf	Moisture Percent
ML	Light brown Clayey Pebbly SILT					
ML	Mottled light tan to light red brown Clayey Gravelly SILT		15-1	35	113	15
CL	Mottled red brown/grey Pebbly Silty CLAY		15-2	32	115	17
	As above with Slickensided low-angle planar shear (SLIDE DEBRIS)		15-3	50		
	As above w/Sandstone cobble (OLDER SLIDE DEBRIS)		15-4	77		
	As above		15-5	59	115	11

Figure Number

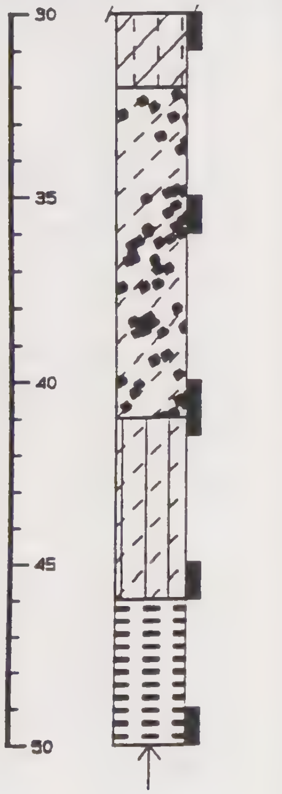
TERRASEARCH, Inc.

LOG OF TEST BORING

BORING 15

Boring No: 15 Project No: 5541
Date Drilled: 11/2/90
Elevation: N/A
Logged by: R.R

Water Level: N/A After: N/A



ELEV / DEPTH	USCS	SOIL DESCRIPTION	REMARKS	Sample No.	Blows foot	Density Dry-pcf	Moisture Percent
30		As above		15-6	92		
		Harder drilling at 31.5'					
	GC	Mottled red brown/light grey Silty Clayey GRAVEL w/ scattered boulders					
35				15-7	92		13
40				15-8	39		
	ML	Grey brown w/red brown mottling Clayey SILT or Silty CLAY, moist, massive (QT1)					
45		Interbedded blue grey Clayey SILT and light red brown very fine grained SANDSTONE (QT1 bedrock)		15-9	72		
		Very hard SANDSTONE or GRAVEL (hard drilling)					
50			Terz. Spl.	15-10	100+		
		Boring terminated at 50 ft No groundwater encountered (refusal)					

Figure Number

TERRASEARCH, Inc.

LOG OF TEST BORING

BORING 16

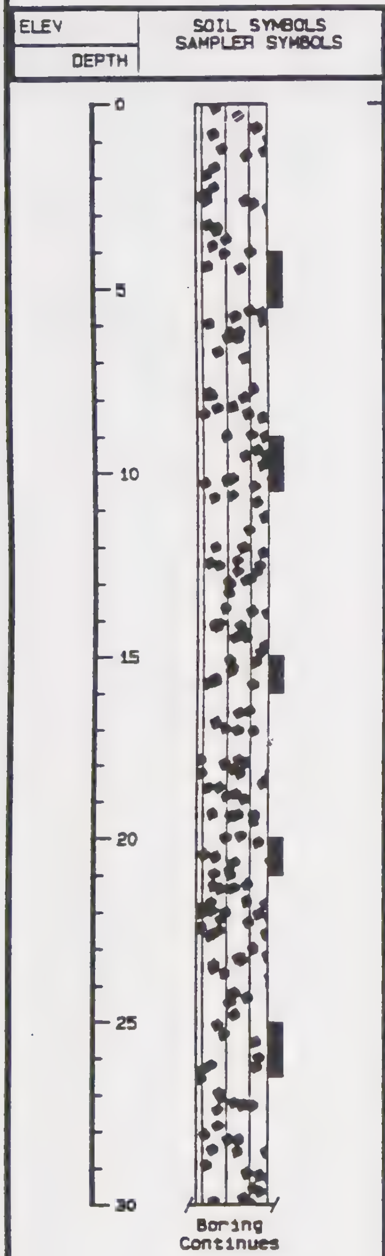
Boring No: 16 | Project No: 5541

Date Drilled: 11/2/90

Elevation: N/A

Logged by: R.R

Water Level: N/A | After: N/A



USCS	SOIL DESCRIPTION	REMARKS	Sample No.	Blows foot	Density Dry-pcf	Moisture Percent
	Light brown Pebbly to Gravelly SILT					
	Mottled red-brown Clayey Sandy Pebbly to Gravelly SILT, dry to slightly moist, dense		16-1	47		
	As above		16-2	52		
	As above (OLD SLIDE DEBRIS)		16-3	52	120	12
	As above w/weathered Sandstone Cobble		16-4	77		
	As above		16-5	40	128	9

Figure Number

TERRASEARCH, Inc.

LOG OF TEST BORING

BORING 16

Boring No: 16 — Project No: 5541
Date Drilled: 11/2/90
Elevation: N/A
Logged by: R.R

Water Level: N/A — After: N/A

ELEV / DEPTH	SOIL SYMBOLS / SAMPLER SYMBOLS	USCS	SOIL DESCRIPTION	REMARKS	Sample No.	Blows foot	Density Dry-pcf	Moisture Percent
30			As above but Gravelly w/ Cobbles		16-6	100+		
35			As above		16-7	100+	118	7
			Hard drilling @ 37'					
		ML	Olive drab w/red brown specks Clayey SILT, moist, massive (QT1)		16-8	62		
40								
			Boring terminated at 40.5 ft No groundwater encountered					

Figure Number

TERRASEARCH, Inc.

LOG OF TEST BORING

BORING 17

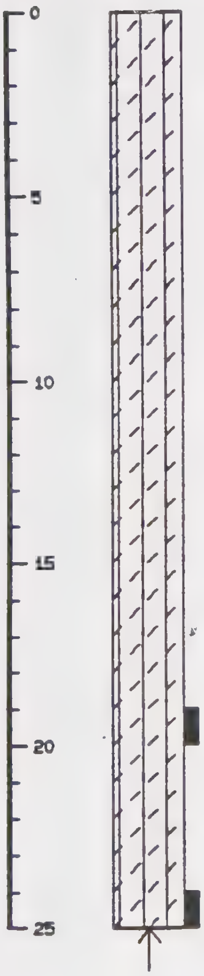
Boring No: 17 — Project No: 5541

Date Drilled: 11/2/90

Elevation: N/A

Logged by: R.R

Water Level: N/A — After: N/A



ELEV / DEPTH	SOIL SYMBOLS / SAMPLER SYMBOLS	USCS	SOIL DESCRIPTION	REMARKS	Sample No.	Blows foot	Density Dry-pcf	Moisture Percent
0		ML	Light to medium brown Pebbly Clayey SILT					
19			Mottled red brown Pebbly Clayey SILT or Pebbly Silty CLAY (SLIDE DEBRIS)		17-1	59	121	12
22–25			Very hard drilling 22-25'					
25			Near Refusal	No Recov.	17-2	77		
			Boring terminated at 25 ft No groundwater encountered					

Figure Number 1.

LOGGED BY MED DATE DRILLED 4/27/87 BORING DIAMETER 6" BORING NO. 18

Depth, ft.	Sample No. and type	Symbol	SOIL DESCRIPTION	Unified Soil Classification	Blows/foot 350 ft-lbs.	Qu - t. s. f. Penetrometer	Dry Density p.c.f.	Moisture % dry wt.	MISC. LAB RESULTS
				CL					
5	1-1		Stiff		28				
			Grades lighter						
10	1-2		w/trace of fine Sand, moist, softer, orange mottling		12				
15			Less Sand, stiffer						
			w/trace of Sand						
			Medium brown Silty Clayey fine to medium SAND	SC					
20	1-3				26				
			Medium brown fine Sandy SILT w/Clay (water 4/27/87)	ML					
25			(water 4/27/87)						
			Medium brown Clayey Sandy GRAVEL	GC					
			Grey Clayey SILT, stiff	ML					
30	1-4				17				
			Stiff, clayey						
			Blue-grey clean fine to medium SAND, hard	SP					
35	1-5				50				
			Boring terminated at 36.5 feet. Groundwater encountered at 26.5 feet, rose to 24 feet.						

TERRASEARCH INC. FIGURE NO. - LOG OF TEST BORING

LOGGED BY MED DATE DRILLED 4/27/87 BORING DIAMETER 6" BORING NO. 19

Depth, ft.	Sample No. and type	Symbol	SOIL DESCRIPTION	Unified Soil Classification	Blows/foot 350 ft-lbs.	Qu - t. s. f. Penetrometer	Dry Density p.c.f.	Moisture % dry wt.	MISC. LAB RESULTS
			Light brown fine Sandy Silty CLAY w/ Gravel, dry, loose	CL					
5	2-1		Medium brown Clayey SILT w/Gravel, moist stiff (grades darker)	ML/ CL	14				
10	2-2		Dark brown Clayey SILT w/fine Gravel, moist		14				
			Grades less Gravel						
15									
	2-3		Tan Silty CLAY, stiff, moist	CL	16				
20			Easier drilling w/trace of fine Sand						
25			Gravel layer						
	2-4		Medium brown Clayey SILT w/Gravel, stiff, moist	ML	16				
30			Easier drilling						
			(water 4/27/87)						
35	2-5 b		Blue-grey Clayey SILT (water 4/27/87)	ML					
	a		Medium brown Clayey SILT	ML	14				
40			Easier drilling						
			Blue-grey Clayey SILT w/Sand						
45	2-6		Blue-grey Silty clean fine to medium SAND	SM	45				

Boring terminated at 46.5 feet. Groundwater at 36 feet, rose to 34 feet.

TERRASEARCH INC. FIGURE NO. - LOG OF TEST BORING

LOGGED BY MED DATE DRILLED 4/27/87 BORING DIAMETER 6" BORING NO. 20

Depth, ft.	Sample No. and type	Symbol	SOIL DESCRIPTION	Unified Soil Classification	Blows/foot 350 ft-lbs.	Qu - t. s. f. Penetrometer	Dry Density p.c.f.	Moisture % dry wt.	MISC. LAB RESULTS
			Medium brown Sandy Silty CLAY w/fine to medium Gravel, loose, dry	CL					
			Dark brown Silty CLAY, moist, harder	CL					
5									
			Medium brown Silty CLAY w/Gravel	CL					
	3-1				16				
			Dark brown Gravelly Silty CLAY	CL					
10									
15	3-2		as above, less Gravel, stiff		13				
			Moist						
20									
			Medium brown Clayey SILT, moist, slightly softer (water at 4/27/87)	ML					
25									
	3-3		(water at 4/27/87) Medium brown Silty fine SAND, moist, very stiff	SM	22				
			Medium brown Sandy Silty CLAY	CL					
30									
			Grades less Sand						
35									
	3-4				23				
			Brown Silty coarse Sandy fine GRAVEL	[illegible]					

Boring terminated at 36.5 feet.
Groundwater at 26.5 feet, rose to 25 feet.

TERRASEARCH INC. FIGURE NO. - LOG OF TEST BORING

LOGGED BY MED DATE DRILLED 4/27/87 BORING DIAMETER 6" BORING NO. 21

Depth, ft.	Sample No. and type	Symbol	SOIL DESCRIPTION	Unified Soil Classification	Blows/foot 350 ft-lbs.	Qu - t. s. f. Penetrometer	Dry Density p.c.f.	Moisture % dry wt.	MISC. LAB RESULTS
			Medium brown Sandy Silty CLAY, dry, loose	CL					
	4-1		Dark brown w/fine Gravel, moist, very stiff		18				
5									
10									
	4-2				18				
			Brown Silty very coarse SAND	SM					
			Dark brown Silty CLAY w/Gravel	CL					
			Light brown Silty CLAY, moist	CL					
15									
			Grades darker w/coarse Gravel						
20									
			Medium brown Clayey SILT, moist, very stiff	ML					
	4-3		Medium brown Silty fine SAND	SM	23				
			(water at 4/27/87)						
25			Gravel layer at 25'						
			Darker brown Silty CLAY w/Gravel	CL					
			Medium brown Silty fine to coarse SAND	SM					
30									
			More Clay rich						
			Blue-grey Silty Sandy GRAVEL, hard	GM					
35									
	4-4		Blue-grey Gravelly Silty CLAY	CL	34				
			Boring terminated at 36.5 feet. Groundwater at 27 feet, rose to 25 feet. Dropped to 26 feet on 5/5/87.						

TERRASEARCH INC.

FIGURE NO. - LOG OF TEST BORING

LOGGED BY MED DATE DRILLED 4/27/87 BORING DIAMETER 6" BORING NO. 22

Depth, ft.	Sample No. and type	Symbol	SOIL DESCRIPTION	Unified Soil Classification	Blows/foot 350 ft-lbs.	Qu - t. s. f. Penetrometer	Dry Density p.c.f.	Moisture % dry wt.	MISC. LAB RESULTS
			Light brown fine Sandy Silty CLAY w/ Gravel, dry, loose	CL					
	5-1		Darker w/finer Gravel		16				
5									
	5-2		As above, more Silt		19				
10			Gravel						
			Medium brown Clayey SILT w/Gravel, moist, stiff	ML					
	5-3				13				
15									
20			As above						
			Silty Clay/Clayey Silt						
25			Gravel layer						
			Medium brown Gravelly Silty CLAY, stiffer, moist	CL					
30			Medium brown Silty CLAY w/Gravel						

TERRASEARCH INC. FIGURE NO. - LOG OF TEST BORING

LOGGED BY MED DATE DRILLED 4/27/87 BORING DIAMETER 6" BORING NO. 22 (con't)

Depth, ft.	Sample No. and type	Symbol	SOIL DESCRIPTION	Unified Soil Classification	Blows/foot 350 ft-lbs.	Qu - t. s. f. Penetrometer	Dry Density p.c.f.	Moisture % dry wt.	MISC. LAB RESULTS
			Gravel layer, moist						
			As above						
35									
			Easier drilling						
			(water 4/27/87)						
			(water 4/27/87)						
40			Blue-grey fine Sandy Silty CLAY, moist, very stiff	CL					
45									
50	5-4				35				
			Boring terminated at 51.5 feet. Groundwater at 39 feet, rose to 38 feet. Dropped to 37 feet on 5/5/87.						

TERRASEARCH INC.

FIGURE NO. - LOG OF TEST BORING

LOGGED BY MED DATE DRILLED 4/27/87 BORING DIAMETER 6" BORING NO. 23

Depth, ft.	Sample No. and type	Symbol	SOIL DESCRIPTION	Unified Soil Classification	Blows/foot 350 ft-lbs.	Qu - t. s. f. Penetrometer	Dry Density p.c.f.	Moisture % dry wt.	MISC. LAB RESULTS
			Medium brown Sandy Silty CLAY, loose, dry	CL					
5			Grades darker, less Sand w/Gravel moist						
10	6-1		Medium brown Clayey SILT w/Gravel	ML	15				
	6-2		Dark brown Silty CLAY, moist, stiff	CL	9				
15	6-3		Medium brown Silty CLAY w/fine Gravel, moist	CL	15				
20			Boring terminated at 20 feet. Dry at time of drilling.						

TERRASEARCH INC.

FIGURE NO. - LOG OF TEST BORING

LOGGED BY MED DATE DRILLED 4/27/87 BORING DIAMETER 6" BORING NO. 24

Depth, ft.	Sample No. and type	Symbol	SOIL DESCRIPTION	Unified Soil Classification	Blows/foot 350 ft-lbs.	Qu - t. s. f. Penetrometer	Dry Density p.c.f.	Moisture % dry wt.	MISC. LAB RESULTS
			Dark brown Silty CLAY w/Gravel, dry, loose	CL					
			Darker, as above, moist						
5									
			Medium brown Gravelly Silty CLAY						
10			Medium brown Sandy Clayey SILT w/Gravel	ML					
	7-1				24				
	7-2		Medium brown Silty CLAY w/Gravel, moist, very stiff	CL	16				
			Medium brown Clayey SILT w/Gravel	ML					
15	7-3		Medium brown Clayey GRAVEL	GC	13				
			Medium brown Clayey SILT w/Gravel, hard, moist	ML					
20	7-4				41				
			Boring terminated at 20.5 feet. Dry at time of drilling.						

TERRASEARCH INC. FIGURE NO. - LOG OF TEST BORING

LOGGED BY MED DATE DRILLED 4/27/87 BORING DIAMETER 6" BORING NO. 25

Depth, ft.	Sample No. and type	Symbol	SOIL DESCRIPTION	Unified Soil Classification	Blows/foot 350 ft-lbs.	Qu - t. s. f. Penetrometer	Dry Density p.c.f.	Moisture % dry wt.	MISC. LAB RESULTS
			Medium brown Gravelly Silty CLAY, dry, loose	CL					
5			Light brown, as above, moist						
			Dark brown Gravelly Silty CLAY, moist, stiff	CL					
10	8-1				14				
15	8-2		W/gravel lense		13				
	8-3				12				
			Boring terminated at 19.5 feet. Dry at time of drilling.						

TERRASEARCH INC.

FIGURE NO. - LOG OF TEST BORING

LOGGED BY MED DATE DRILLED 4/27/87 BORING DIAMETER 6" BORING NO. 26

Depth, ft.	Sample No. and type	Symbol	SOIL DESCRIPTION	Unified Soil Classification	Blows/foot 350 ft-lbs.	Qu - t.s.f. Penetrometer	Dry Density p.c.f.	Moisture % dry wt.	MISC. LAB RESULTS
			Dark brown Gravelly Silty CLAY, dry, loose	CL					
			Grades darker and moister						
5									
			Dark brown Silty CLAY						
			Medium brown Clayey SILT with fine Gravel	ML					
10	9-1				15				
	9-2		Darker brown Gravelly Silty CLAY, moist, stiff	CL	11				
15									
	9-3		Medium brown Silty CLAY with Gravel, moist	CL	15				
20	9-4		Mottled grey and brown Clayey SILT with Gravel	ML	15				
			Boring terminated @ 20.5 feet, dry						

TERRASEARCH INC. FIGURE NO. - LOG OF TEST BORING

LOGGED BY MED DATE DRILLED 4/28/87 BORING DIAMETER 6" BORING NO. 27

Depth, ft.	Sample No. and type	Symbol	SOIL DESCRIPTION	Unified Soil Classification	Blows/foot 350 ft-lbs.	Qu - t. s. f. Penetrometer	Dry Density p.c.f.	Moisture % dry wt.	MISC. LAB RESULTS
	10-1		Brown Silty CLAY w/Gravel, loose, dry, with carbon specks	CH	15				
5			Dark brown Silty CLAY, moist	CH/CL					
	10-2		Mottled orange and grey-brown Clayey SILT with carbon specks, moist, very stiff	ML	26				
10			Lighter in color						
	10-3				16				
15			Dark brown Silty CLAY	CL					
	10-4		Grey-brown Clayey SILT, moist, very stiff	ML	18				
20			Grey-brown Silty CLAY	CL					
			Grey-brown Clayey SILT	ML					
25			(water 4/28/87)						
30									
35	10-5		Gradational contact, grades bluer		23				
			Blue-grey Clayey SILT						

Boring terminated @ 36.5 feet
Groundwater encountered @ 25 feet
Rise to 24.5 feet
Rise to 23 feet by 5/5/87

TERRASEARCH INC. FIGURE NO. -LOG OF TEST BORING

LOGGED BY MED DATE DRILLED 4/28/87 BORING DIAMETER 6" BORING NO. 28

Depth, ft.	Sample No. and type	Symbol	SOIL DESCRIPTION	Unified Soil Classification	Blows/foot 350 ft-lbs.	Qu - t. s. f. Penetrometer	Dry Density p.c.f.	Moisture % dry wt.	MISC. LAB RESULTS
			Medium brown Silty CLAY, loose, dry	CL					
5			Darker brown Silty CLAY, moist						
	11-1		w/Clayey Silt, easier drilling		23				
10			Lighter brown						
	11-2		Grey brown Silty CLAY with some orange mottling		15				
			Darker brown Clayey SILT, moist, stiff	ML					
15			Lighter brown Clayey SILT						
			Darker brown Clayey SILT						
20	11-3		Mottled light brown grey Clayey SILT, moist		12				
			(water 4/28/87)						
25			(water 4/28/87)						
30			Medium brown Clayey Silty fine SAND	SM					
			Grades darker						
			Blue grey Silty fine medium SAND, hard	SM					
35	11-4		Blue grey Silty Sandy GRAVEL	GM	43				

Boring terminated @ 36.5 feet
Groundwater encountered @ 25 feet
Rise to 22 feet

TERRASEARCH INC. FIGURE NO. - LOG OF TEST BORING

LOGGED BY MED DATE DRILLED 4/28/87 BORING DIAMETER 6" BORING NO. 29

Depth, ft.	Sample No. and type	Symbol	SOIL DESCRIPTION	Unified Soil Classification	Blows/foot 350 ft-lbs.	Qu - t. s. f. Penetrometer	Dry Density p.c.f.	Moisture % dry wt.	MISC. LAB RESULTS
			Brown Silty CLAY, dry, loose	CL					
			Medium brown Silty CLAY, moist, denser	CL					
5									
	12-				23				
10									
			Darker brown, moist, very stiff						
			Light brown with orange mottling Clayey SILT	ML					
15	12-				21				
			Darker						
20			Lighter Silty CLAY, moist, very stiff	CL					
			Light orange-brown-grey Silty CLAY						
25	12-		(water 4/28/87)		16				
			Light orange-brown-grey Clayey SILT	ML					
30			w/fine Sand						
35	12-4		Mottled orange-brown-grey Clayey fine Sandy SILT	ML	24				
			Boring terminated @ 36.5 feet Groundwater encountered @ 26 feet						

TERRASEARCH INC. FIGURE NO. - LOG OF TEST BORING

LOGGED BY MED DATE DRILLED 4/28/87 BORING DIAMETER 6" BORING NO. 30

Depth, ft.	Sample No. and type	Symbol	SOIL DESCRIPTION	Unified Soil Classification	Blows/foot 350 ft-lbs.	Qu - t.s.f. Penetrometer	Dry Density p.c.f.	Moisture % dry wt.	MISC. LAB RESULTS
			Light brown fine Sandy Silty CLAY, loose dry	CL					
			Darker brown Silty CLAY, moist						
5	13-1		Medium brown Clayey Silty GRAVEL	GM	6				
			Medium brown Clayey SILT Gravelly	ML					
10	13-2		Dark brown Gravelly Silty CLAY, moist, stiffer	CL	15				
15			Lighter brown with Gravels						
20	13-3		Mottled orange-brown-grey Gravelly Silty CLAY, moist, very stiff		21				
25			Clayey SILT/Silty CLAY						
			Lighter						
30			Less Gravel						
35			▼ (water 4/28/87)						
			Light brown Silty CLAY with Gravel						
40			Light brown fine Sandy Clayey SILT, very stiff	ML					
45	13-4				17				
			Boring terminated @ 46.5, Groundwater encountered @35 feet, Rise to 33 feet on 5/5/87						

TERRASEARCH INC. FIGURE NO. - LOG OF TEST BORING

LOGGED BY MED DATE DRILLED 4/28/87 BORING DIAMETER 6" BORING NO. 31

Depth, ft.	Sample No. and type	Symbol	SOIL DESCRIPTION	Unified Soil Classification	Blows/foot 350 ft-lbs.	Qu - t. s. f. Penetrometer	Dry Density p.c.f.	Moisture % dry wt.	MISC. LAB RESULTS
			Brown Silty CLAY, loose, dry	CL					
			Darker brown Silty CLAY, moist						
5									
10			Medium brown Silty Gravelly CLAY	CL					
	14-1		Medium brown Gravelly Clayey SILT, moist stiff	ML	14		115	16	
15	14-2				14		121	13	LL=36 PI=18 Qu=2947 psf
20									
25	14-3		Light brown fine Gravelly Clayey SILT		16		110	20	
30									
			▽ Perched						
35	14-4		▼		24		114	18	
			Mottled light orange-brown-grey Clayey SILT with Gravel						
40									
45	14-5		Blue-grey Silty fine SAND		25		116	17	
			Boring terminated @ 46.5 feet, Perched groundwater @ 34.5 feet, drop to 36.5 feet						

TERRASEARCH INC. FIGURE NO. - LOG OF TEST BORING

LOGGED BY MED DATE DRILLED 4/28/87 BORING DIAMETER 6" BORING NO. 32

Depth, ft.	Sample No. and type	Symbol	SOIL DESCRIPTION	Unified Soil Classification	Blows/foot 350 ft-lbs.	Qu - t. s. f. Penetrometer	Dry Density p.c.f.	Moisture % dry wt.	MISC. LAB RESULTS
			Medium brown Silty CLAY w/fine Sand, dry, loose	CL					
			w/Gravel						
5	15-1		Darker brown Gravelly Silty CLAY, moist, very stiff		20				
			Lighter, less Gravel, wet						
10									
15	15-2		Light brown Silty CLAY with Gravel, moist		13				
20			Silty CLAY, stiffer, moist						
25	15-3		Medium brown Silty CLAY with Gravel		17				
			Lighter brown						
30									

TERRASEARCH INC.

FIGURE NO. - LOG OF TEST BORING

LOGGED BY MED DATE DRILLED 4/28/87 BORING DIAMETER 6" BORING NO. 32 cont.

Depth, ft.	Sample No. and type	Symbol	SOIL DESCRIPTION	Unified Soil Classification	Blows/foot 350 ft-lbs.	Qu - t. s. f. Penetrometer	Dry Density p.c.f.	Moisture % dry wt.	MISC. LAB RESULTS
			Dark brown Silty CLAY with Gravel, stiffer, moist						
			Blue-grey Silty CLAY	CL/CH					
			Grades darker						
35	15-4		Light orange-brown Silty Clayey GRAVEL, very moist, very stiff	GC	25				
			(water 4/28/87)						
40									
			Blue-grey Silty CLAY	CL					
45									
50	15-5				25				
			Boring terminated @ 51.5 feet Groundwater encountered @ 38 feet Rise to 37 feet						

TERRASEARCH INC. FIGURE NO. - LOG OF TEST BORING

LOGGED BY MED DATE DRILLED 4/28/87 BORING DIAMETER 6" BORING NO. 33

Depth, ft.	Sample No. and type	Symbol	SOIL DESCRIPTION	Unified Soil Classification	Blows/foot 350 ft-lbs.	Qu - t. s. f. Penetrometer	Dry Density p.c.f.	Moisture % dry wt.	MISC. LAB RESULTS
			Medium brown Silty CLAY, loose, dry	CL					
5									
			Darker brown Silty CLAY with Gravel, moist	CL					
10	16-1				18				
15			Grades lighter brown						
			Grades darker, moist, very stiff						
20	16-2		Light brown Silty Gravelly CLAY		23				
			Light brown Gravelly Silty CLAY, moist, very stiff						
25									
30									

TERRASEARCH INC. FIGURE NO. - LOG OF TEST BORING

LOGGED BY MED DATE DRILLED 4/28/87 BORING DIAMETER 6" BORING NO. 33 (cont)

Depth, ft.	Sample No. and type	Symbol	SOIL DESCRIPTION	Unified Soil Classification	Blows/foot 350 ft-lbs.	Qu - t.s.f. Penetrometer	Dry Density p.c.f.	Moisture % dry wt.	MISC. LAB RESULTS
	16-3				22				
35			Moist						
			Dark grey Silty CLAY	CL					
40									
			Blue grey Silty CLAY, very moist						
			▽ perched						
45									
50			Less Silt, moist, stiffer	CH/ CL					
			Blue-grey Clayey fine Sandy SILT very stiff ▼	ML					
55	16-4		(water 4/28/87)		22				
			Boring terminated @ 56.5 feet Groundwater perched @ 44 feet Drop to 55 feet Cavede 35 feet on 5/5/87						
60									

TERRASEARCH INC. FIGURE NO. - LOG OF TEST BORING

LOGGED BY MED DATE DRILLED 4/28/87 BORING DIAMETER 6" BORING NO. 34

Depth, ft.	Sample No. and type	Symbol	SOIL DESCRIPTION	Unified Soil Classification	Blows/foot 350 ft-lbs.	Qu - t. s. f. Penetrometer	Dry Density p.c.f.	Moisture % dry wt.	MISC. LAB RESULTS
			Medium brown Silty CLAY, dry, loose	CL					
5			Darker brown Gravelly Silty CLAY, moist stiffer						
	17-1				11				
10	17-2		Gravel layer		16				
			Lighter in color						
15									
20	17-3		Light brown Clayey SILT, stiff, moist	ML	15				
25									
			Graditional contact						
30	17-4		Light brown Silty CLAY with cobbles	CL	18				
			Light brown Gravelly Silty CLAY						
35			With Gravel						
			Grades darker						
40			(water 4/28/87)						
45	17-5		Medium brown Gravelly Silty CLAY		29				
			Boring terminated @ 46.5 feet, Groundwater encountered @ 41 feet. Rise to 38 feet						

TERRASEARCH INC. FIGURE NO. - LOG OF TEST BORING

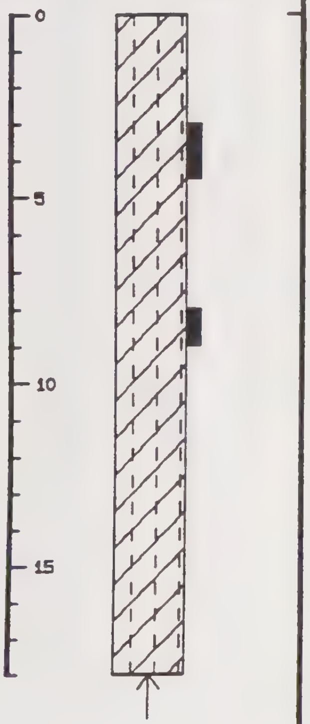
LOG OF TEST BORING

BORING 35

Boring No: 35 Project No: 5541
Date Drilled: 9-11-90
Elevation: N.A.
Logged by: DVC

Water Level: N.A. After: N.A.

ELEV / DEPTH — SOIL SYMBOLS / SAMPLER SYMBOLS



USCS	SOIL DESCRIPTION	REMARKS	Sample No.	Blows foot	Density Dry-pcf	Moisture Percent
ML/ CL	Medium brown Silty CLAY/ Clayey SILT w/minus 1/8 clast Gravel, dry, loose to firm					
	Stiffening	LL=34 PI=15	35-1	31	105	8
	Grading to CLAY w/slight moisture		35-2	36	113	13
	As above, rounded 1/2" clasts Gravel					
	Boring terminated at 18 ft No groundwater encountered					

Figure Number

TERRASEARCH, Inc.

LOG OF TEST BORING

BORING 36

Boring No: 36
Date Drilled: 9-11-90
Elevation: N.A.
Logged by: DVC

Project No: 5541

Water Level: N.A. After: N.A.

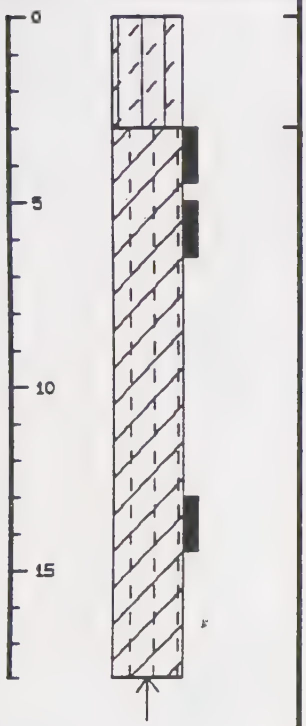
ELEV / DEPTH	SOIL SYMBOLS / SAMPLER SYMBOLS	USCS	SOIL DESCRIPTION	REMARKS	Sample No.	Blows foot	Density Dry-pcf	Moisture Percent
0			Medium brown Clayey SILT/ Silty CLAY w/minus 1" round Gravel, loose to firm					
		CL	Dark brown Silty CLAY w/ minus 1" angular Gravel, mottled w/red black, wet, soft, firm	Qu= 1344 psf	36-1	8	94	19
5					36-2	6	98	18
10			Medium brown					
					36-3	18	113	15
15								
			Boring terminated at 18 ft No groundwater encountered					

Figure Number

TERRASEARCH, Inc.

LOG OF TEST BORING

BORING 37

Boring No: 37
Date Drilled: 9-11-90
Elevation: N.A.
Logged by: DVC

Project No: 5541

Water Level: N.A.   After: N.A.

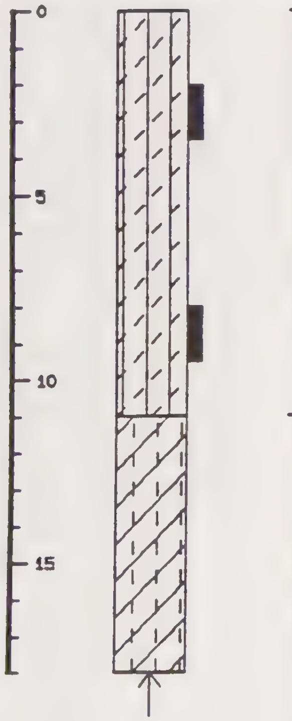
ELEV / DEPTH	SOIL SYMBOLS / SAMPLER SYMBOLS	USCS	SOIL DESCRIPTION	REMARKS	Sample No.	Blows foot	Density Dry-pcf	Moisture Percent
		ML/ CL	Medium brown Clayey SILT, dry to moist, loose to firm w/fine Sands		37-1	16	116	8
			As above		37-2	22	99	15
		CL	Light brown Silty CLAY, moist, firm to stiff					
			Boring terminated at 18 ft No groundwater encountered					

Figure Number

TERRASEARCH, Inc.

LOG OF TEST BORING

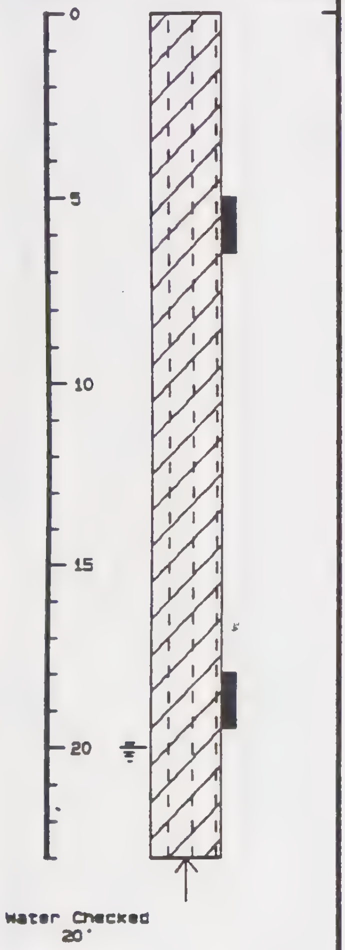
BORING 38

Boring No: 38
Date Drilled: 9-11-90
Elevation: N.A.
Logged by: DVC

Project No: 5541

Water Level: 20'

After: 20'



ELEV / DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS	USCS	SOIL DESCRIPTION	REMARKS	Sample No.	Blows foot	Density Dry-pcf	Moisture Percent
0		CL	Dark brown Silty CLAY, moist to wet, firm					
5				C=580 psf 0=25	38-1	26	101	25
10			Light brown Sandy Silty CLAY, dry to moist, firm to stiff					
15			Medium to dark brown Silty CLAY, mottled w/gray, moist to wet, firm to stiff					
					38-2	12	103	21
20			Water @ 20' at time of drilling					
			Boring terminated at 23 ft Water at 20 ft					

Figure Number

TERRASEARCH, Inc.

LOG OF TEST BORING

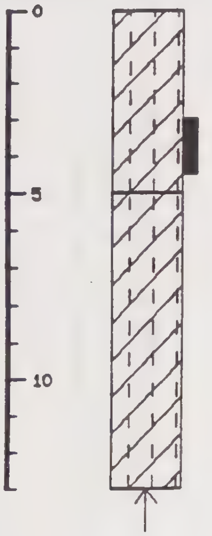
BORING 39

Boring No: 39
Date Drilled: 9-11-90
Elevation: N.A.
Logged by: DVC

Project No: 5541

Water Level: 20'

After: 20'



ELEV / DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS	USCS	SOIL DESCRIPTION	REMARKS	Sample No.	Blows foot	Density Dry-pcf	Moisture Percent
0		ML/ CL	Light brown Silty CLAY/Clayey SILT, dry, loose					
				LL=37 PI=16	39-1	28	109	7
5		CL	Medium brown Silty CLAY, dry to moist, firm to stiff w/ 1/4" minus rounded Gravel					
10								
			Boring terminated at 13 ft No groundwater encountered					

Figure Number

TERRASEARCH, Inc.

LOGGED BY RR DATE DRILLED 5/14-15/92 BORING DIAMETER 3" core BORING NO. 40

Depth ft.	Coring Interval	Recovery (in.)	Coring time (minutes)	LOCATED 21' SOUTH OF BORING A SOIL DESCRIPTION	REMARKS
				Light brown Gravelly Clayey SILT, Gravelly to 19'	Drilled 0-60' with rotary wash
5					
10					
15					
20				Tan to light red brown Clayey SILT with scattered pebbles	
25				Color change to blue grey	
30					

TERRASEARCH INC. FIGURE NO.

LOGGED BY RR	DATE DRILLED 5/14-15/92	BORING DIAMETER 3" core	BORING NO. 40

Depth ft.	Coring Interval	Recovery (in.)	Coring time (minutes)	SOIL DESCRIPTION	REMARKS
				Blue grey Clayey SILT	
35					
40					
				Color change to light red brown Clayey SILT	
45					
				Pebbly to Gravelly coarse SAND and/or fine GRAVEL	
50					
				Blue grey Clayey SILT	
55					
60					

TERRASEARCH INC.

FIGURE NO.

LOGGED BY DB/ DATE DRILLED 5/14-15/92 BORING DIAMETER 3"core BORING NO. 40

Depth ft.	Coring Interval	Recovery (in.)	Coring time (minutes)	SOIL DESCRIPTION	REMARKS
		30		Blue grey Clayey SILT with scattered coarse Sand grains	Started coring at 60'
		30			
65		26		As above with scattered irregular hard calcareous pods	
		30			
70		28		Blue grey Clayey Silty very fine grained SAND with occasional coarse granules, and hard calc. pods or blebs.	
		30		Sandy Clayey SILT as before	
75		26		As above with scattered pebbles to 1/2"	
		19		Loose pebbly SAND	
				SILT	
80				Loose pebbly SAND	
		27		Sandy Clayey SILT Subhorizontal 2" strata dark grey CLAY at 82'	wrapped
		22		Change to olive brown Silty CLAY/Clayey SILT with irregular slickensided spots	
85		30		Blue grey 18", greenish brown 18" Clayey SILT with fine Sand	
		30		Blue grey Clayey SILT with fine Sand, sandy seam at 89'; Sand is = 90% rounded quartz	
90					

TERRASEARCH INC. FIGURE NO.

LOGGED BY DB DATE DRILLED 5/14-15/92 BORING DIAMETER 3" core BORING NO. 40

Depth ft.	Coring Interval	Recovery (in.)	Coring time (minutes)	SOIL DESCRIPTION	REMARKS
		25		4" clayey seam sluff? at 90' Blue grey Clayey SILT with Sand; Sandy layer at 92'	
		9 9		Blue grey fine Silty SAND, rounded quartz grains, hard boulder? at 93.5'-just pushed to 93' Darker blue grey, Gravelly at 94'	
95		24		Blue grey 94.5-95 fine Sand; 95-96.5' Clayey SILT, bottom 2" Sandy	
		14		Blue grey Gravelly 98=98.5', Pitcher tube distorted during sampling	
100		29		Blue grey Gravelly with coarse Sand 98.5-100.5'; Silty for 3"; Sandy for 3"	
		14		Blue grey Gravelly medium to coarse SAND	
		14		Dark stained 1/2" spot at 104'	
105		22		Blue grey SAND, slightly Silty, rounded quartz grains fine to medium grained	
		23		Blue grey, top 4" as above SAND; then Gravelly to 110', calcareous deposits in spots; = horizontal contact between Sand and Gravel; slightly gradational	
110				Boring terminated at 110'.	

TERRASEARCH INC. FIGURE NO.

LOGGED BY DB DATE DRILLED 5/15-27/92 BORING DIAMETER 3" core BORING NO. 41

Depth ft.	Coring Interval	Recovery (in.)	Coring time (minutes)	SOIL DESCRIPTION	REMARKS
				Brown Silty CLAY with coarse Sand and Gravel, angular grains	Drilled to 40' Started coring at 40'
5					
30					
				Blue grey Silty CLAY with trace fine Sand	
35					
40					
		9		Blue grey quartz SAND fine to medium grained, falls apart when transfered to core box	
		26			
45					
		27		Gravelly pockets	
		12			
50		29			

TERRASEARCH INC. FIGURE NO.

LOGGED BY DB DATE DRILLED 5/15-27/92 BORING DIAMETER 3" core BORING NO. 41

Depth ft.	Coring Interval	Recovery (in.)	Coring time (minutes)	SOIL DESCRIPTION	REMARKS
		29		Blue grey Gravelly SAND	Hard chert gravels tear Pitcher Tube cutters: 5 tubes used 42.5-55'
		24			
		9			
55					
		28		Clayey	
		23			Drilled from 59-1/2 to 74-1/2'
60					
65					
70					Water at 70.0'- 7 AM on 5/20/92
75		18		Blue grey Gravelly coarse SAND with trace of Silt and Clay, gravels tore bit, drilled to 83', Clayey seam at 82' back to coarse sand at 83'	Drilled from 76 to 83'
80					

TERRASEARCH INC. FIGURE NO.

LOGGED BY DB DATE DRILLED 5/15-27/92 BORING DIAMETER 3" core BORING NO. 41

Depth ft.	Coring Interval	Recovery (in.)		SOIL DESCRIPTION	REMARKS
		30			
85					
		21			
		14			
		9			
90		18		1 inch white quartz fragment	
		14			
		6		Hard piece of calcite-cemented Sandstone at 94'	
95		23			
				Silty CLAY or Clayey SILT with fine Sand; sandier 100-102'	
		26			
100		17			
		25		SAND	
				H_2S smell at 105'	
105		24		SILT or CLAY: pervasively sheared 105-107'	
		29		Contact between fine Sandy CLAY and Silty CLAY? 53 degree- reliable measure, with Sand and Gravel 109-111'	
110		22			

TERRASEARCH INC. FIGURE NO.

LOGGED BY DB DATE DRILLED 5/15-27/92 BORING DIAMETER 3" core BORING NO. 41

Depth ft.	Coring Interval	Recovery (in.)	Coring time (minutes)	SOIL DESCRIPTION	REMARKS
		22			
		14		Coarse SAND with Gravel, well graded, rounded grains grading to Sandy GRAVEL at 114'	
115		25		GRAVEL	
		0			
120		10		Sandy GRAVEL, grains more angular, slightly silty at 121'	
		22		Silty fine SAND	
125		18			
		28		Sand coarser, strong H_2S smell, less silt and clay, subangular to subrounded grains, H_2S smell continues to 130-1/2'	
130		30			
		30		No more smell	
		19		Coarse SAND and GRAVEL; H_2S smell, increasing Gravel to 136'	
135		12			
		10		Hard plug of $CaCO_3$ cemented Sandstone at 137'	Drilled 137.0 to 138.5'
				Gravelly SAND	
140		19			

TERRASEARCH INC. FIGURE NO.

LOGGED BY RR DATE DRILLED 5/15-27/92 BORING DIAMETER 3" core BORING NO. 41

Depth ft.	Coring Interval	Recovery (in.)	Coring time (minutes)	SOIL DESCRIPTION	REMARKS
		4		Hard calcite cemented rock at 141'	
		30	2.5	Blue grey Clayey SILT-massive, homozeneous and/or very fine Sand	
				Broken fragment of slickensided CLAYSTONE at top of run (@143.5)	
145		20	5.5	As above with hard calcareous nodules to 3" diameter	
		18	16		
				Blue grey fine SAND with layers Clayey SILT	
		29	4	Clayey SILT	
150					
		5	14	Dark grey cemented chert and Sandstone at 151'	
		22	9	Dark blue grey coarse to very coarse Gravelly SAND with thin interbeds Sandy GRAVEL; isolated cobbles to 3+" diameter; rythmically bedded	
155		22	7		
		26	4	As above with fine grained strata	
160		14	9		
		25	3	As above with interbedded very coarse pebbly to Gravelly SAND and fine to very fine SAND; soft, loose	
		20	5		
165		11	15	4" layer of hard cemented SILTSTONE or very fine SANDSTONE with basal bedding contact dipping 10 degrees	
		12	10	Coarse Silty to Gravelly SAND as before	
				Very fine Silty SAND	
		18	7	Coarse Gravelly SAND interbedded with fine loose Sand alternating soft and hard layers	
		18	4	4" layer dark grey micaceous SILTSTONE	
170				(fissility parallels layer = 5 degrees bedding dip)	

LOGGED BY RR DATE DRILLED 5/15-27/92 BORING DIAMETER 3" core BORING NO. 41

Depth ft.	Coring Interval	Recovery (in.)	Coring time (minutes)	SOIL DESCRIPTION	REMARKS
	X	30	3	Coarse Gravelly to Silty SAND as before; pebbles at 171'	
	X	30	6	Blue grey Clayey SILTSTONE; soft, massive, moist	
175	X	29.5	8		
	X	22	7	As above with subhorizontal Clay bedding laminae bottom 6"	
180	X	24	9	As above with calc.—cemented pods in bottom 4"	
	X	30	6		
185	X	28	7		wrapped
	X	27	9	Blue grey Clayey SILTSTONE as above soft Near horizontal Clay laminae(bedding?) at 189.1'	
190	X	33	9	As above with irregular calcite nodules starting at about 191'	
	X	30	11	As above with Clay bedding laminae bottom 6"	wrapped
195	X	32	5	As above	
	X	30	4	As above but grading slightly coarser (locally to very fine grained SAND)	
200					

TERRASEARCH INC. FIGURE NO.

LOGGED BY RR/DB DATE DRILLED 5/15-27/92 BORING DIAMETER 3" core BORING NO. 41

Depth ft.	Coring Interval	Recovery (in.)	Coring time (minutes)	SOIL DESCRIPTION	REMARKS
		29	4	As above but lenses coarse pebbly SAND in bottom 4"	
		16	5	Dark blue grey coarse pebbly SAND with lenses SILTSTONE, subrounded pebbles to 2" diameter	
205		22	12	As above, pebbly to Gravelly SAND(or thinly interbedded GRAVEL, SAND, and SILT with subhorizontal bedding)	
		20	12	As above	
210		19	8		Drilled to clean out hole: 211.5-212.5'
		18	5		
215		16	8	Gravelly SAND	
		16	10		
		6	5		
220		0	5	Tried to core again 3" no recovery, drilled to 222-1/2' with rock bit	
				Hard	
		19	7	Sandy GRAVEL and fine Sandy CLAY or SILT-2nd foot	
225		30	10	Silty CLAY, hard	
		28	10	As above with fine SAND / Sandstone structure	
230					

TERRASEARCH INC.

FIGURE NO.

LOGGED BY DB DATE DRILLED 5/15-27/92 BORING DIAMETER 3" core BORING NO. 41

Depth ft.	Coring Interval	Recovery (in.)	Coring time (minutes)	SOIL DESCRIPTION	REMARKS
		25	10	Blue grey Silty CLAY, hard, moist, dense, massive structure, irregular surfaces in induced core fractures (breaking apart by hand).	
		23	9		
235		24	9	As above with fine Sand, top 3" softened with drill fluid-discarded	
		14	8	Grades to?-Blue grey Clayey fine SAND, very dense, moist, massive, rough surface (when broken by hand)	
240		30	9	More Clayey, grades? to CLAY	
		24	9	As above, irregular fracture Grades? to	
245		23	8	SAND Blue grey Clayey fine SAND, dense, hard to break, irregular fracture	
		17	8	Sandier, slightly easier to break	
250		31	7	As above with calcareous spots	
		19	?		
255		21	9	Blue grey Clayey fine SAND, slightly moist, extremely dense, rough fracture (BBP) calcareous spots	wrapped at 257.0-257.5'
		29	9		
260				BORING TERMINATED AT 260'.	

TERRASEARCH INC. FIGURE NO.

LOGGED BY R.R. DATE DRILLED 6/9-11/92 BORING DIAMETER 3" core BORING NO. 42

Depth ft.	Coring Interval	Recovery (in.)	Coring time (minutes)	Located 150' East of Panch Road SOIL DESCRIPTION	REMARKS
				Light brown pebbly Siltv CLAY	
5					
				—as above, grading mottled red brown w/ scattered gravels	
10					
15					
				—mottled red brown Pebbly Silty CLAY	
20					
				—firmer at 22', light/medium brown	
				Mottled red brown/blue grey/tan Pebbly Silty CLAY w/angular to well rounded Pebbles to 1-1/2": chaotic texture, varied zones	
25					
	X	30	4	—45 degree shear @ 26.7'	wrapped
	X	27	5		
				—5" well rounded cobble	
30					

TERRASEARCH INC. FIGURE NO.

LOGGED BY RR DATE DRILLED 6/9-11/92 BORING DIAMETER 3" core BORING NO. 42

Depth ft.	Coring Interval	Recovery (in.)	Coring time (minutes)	SOIL DESCRIPTION	REMARKS
		30	6	Zone of very dark brown matrix Clayey SAND w/ Gravel to 6".	
		24	4	Dense Sandy Clayey GRAVEL w/pods of loose pea gravel	
35		12	3	Loose GRAVEL, 1/8" to 1-1/4" (some slough?)	Drilled out Gravel at 36-39.5'
				1" Gravel 1" thick medium/dark grey Clay layer (Base Qlr?) at contact	
40		21	5	Finely laminated tan/black Silty very fine SAND and Sandy SILT, black carbonaceous laminae may produce black "oil" scum in drilling mud	(wrapped)
		4	6	—dark grey Clayey SILT	
45		15	10	Mottled tan/dark grey Clayey Pebbly SILT: angular clasts dark grey Shale, brecciated texture; angular clasts to 3", vertical fracture in Siltstone	Gravel sloughing on top of sampler
		17	3		
		12	3		
		12	3		
50				Gravelly SAND & Sandy GRAVEL, some broken well-rounded cobbles to 6" diameter	drilled out and grouted at 50.5' to 51.0'
		23	5	Chaotic mixture of grey black Clay & Silt, light olive Sand and rounded Pebbles (laminae juxtaposed by fractures)	
		16	4	—as above, top of old Slide Debris?	
55					
		12	7	Very dark grey Gravelly CLAY; bottom 4" calcite-cemented w/brecciated texture; hard coring (old slide debris)	
		12	6		
60					

LOGGED BY RR DATE DRILLED 6/9-11/92 BORING DIAMETER 3" core BORING NO. 42

Depth ft.	Coring Interval	Recovery (in.)	Coring time (minutes)	SOIL DESCRIPTION	REMARKS
		18	3	—as above (interbedded Gravelly Clay & Clavey Gravel (SLIDE DEBRIS)	Fluid loss @ 61'
		21	13	—as above (SLIDE DEBRIS)	
65		14	15		
		15	10	—as above (angular fragments dark grey Siltstone in very dark grey Clay matrix: OLD SLIDE DEBRIS	
70		14	10		
		17	16	—as above, very dark grey Gravelly CLAY (OLD SLIDE DEBRIS)	
75		18	10		
		14	10		
		16	4		at 80' changed to narrower sampler to try to improve recovery
80		21	14		
		30	14		
85		0	10		
				Apparently unsheared contact at 88.2'	(?base of old slide?)
		18	3	Blue grey Pebbly SANDSTONE	
90		18	12	Blue green Silty CLAY w/khaki mottling· abundant white caliche seams and nodules	

LOGGED BY RR DATE DRILLED 6-9/11/92 BORING DIAMETER 3" core BORING NO. 42

Depth ft.	Coring Interval	Recovery (in.)	Coring time (minutes)	SOIL DESCRIPTION	REMARKS
		18	10	Mottled blue grey green fine Sandy Clayey SILTSTONE, caliche vein undulating @ low angle, hint of disturbed bedding	
		11	15	Blue grey fine Sandy CLAY, massive	
		0	17	No recovery, plugged up around outside of core barrel	
95		18	2	Blue grey green fine SAND, rounded grains, clean quartz Sand; Gravel lens at 96.5'	Change to Pitcher Tube
		30	3		
100		30	2		
		30	1 min 10 sec	—as above, but with 2 clay seams top 1" thick bedding inclined about 15 degrees	
105		24	1 min 10 sec	—as above with coarser Sand	
		12	5	—as above, coarse Sand w/shale fragments derived from Cretaceous	
110		18	5		
		6	4	—as above with more rock fragments	
115					
				Coring terminated at 116.5' NOTE: Put piezometer in hole; 120' of 1" pipe, bottom 30' slotted, 40' sand with betonite pellets on top; backfill annulas with cutiings.	

TERRASEARCH INC. FIGURE NO.

LOGGED BY RR DATE DRILLED 5/15-27/92 BORING DIAMETER 3" core BORING NO. 41

Depth ft.	Coring Interval	Recovery (in.)	Coring time (minutes)	SOIL DESCRIPTION	REMARKS
		4		Hard calcite cemented rock at 141'	
		30	2.5	Blue grey Clayey SILT-massive, homozeneous and/or very fine Sand Broken fragment of slickensided CLAYSTONE at top of run (@143.5)	
145		20	5.5	As above with hard calcareous nodules to 3" diameter	
		18	16		
				Blue grey fine SAND with layers Clayey SILT	
		29	4	Clayey SILT	
150					
		5	14	Dark grey cemented chert and Sandstone at 151'	
		22	9	Dark blue grey coarse to very coarse Gravelly SAND with thin interbeds Sandy GRAVEL; isolated cobbles to 3+" diameter; rythmically bedded	
155		22	7		
		26	4	As above with fine grained strata	
160		14	9		
		25	3	As above with interbedded very coarse pebbly to Gravelly SAND and fine to very fine SAND; soft, loose	
		20	5	4" layer of hard cemented SILTSTONE or very fine SANDSTONE with basal bedding contact dipping	
165		11	15	10 degrees Coarse Silty to Gravelly SAND as before	
		12	10	Very fine Silty SAND	
		18	7	Coarse Gravelly SAND interbedded with fine loose Sand alternating soft and hard layers	
		18	4	4" layer dark grey micaceous SILTSTONE	
170				(fissility parallels layer = 5 degrees bedding dip)	

TERRASEARCH INC. | FIGURE NO.

LOGGED BY RR DATE DRILLED 5/15-27/92 BORING DIAMETER 3" core BORING NO. 41

Depth ft.	Coring Interval	Recovery (in.)	Coring time (minutes)	SOIL DESCRIPTION	REMARKS
		30	3	Coarse Gravelly to Silty SAND as before; pebbles at 171'	
		30	6	Blue grey Clayey SILTSTONE; soft, massive, moist	
175		29.5	8		
		22	7	As above with subhorizontal Clay bedding laminae bottom 6"	
180		24	9	As above with calc.—cemented pods in bottom 4"	
		30	6		
185		28	7		wrapped
		27	9	Blue grey Clayey SILTSTONE as above soft Near horizontal Clay laminae(bedding?) at 189.1'	
190		33	9	As above with irregular calcite nodules starting at about 191'	
		30	11	As above with Clay bedding laminae bottom 6"	wrapped
195		32	5	As above	
		30	4	As above but grading slightly coarser (locally to very fine grained SAND)	
200					

TERRASEARCH INC. | FIGURE NO.

LOGGED BY RR/DB DATE DRILLED 5/15-27/92 BORING DIAMETER 3" core BORING NO. 41

Depth ft.	Coring Interval	Recovery (in.)	Coring time (minutes)	SOIL DESCRIPTION	REMARKS
		29	4	As above but lenses coarse pebbly SAND in bottom 4"	
		16	5	Dark blue grey coarse pebbly SAND with lenses SILTSTONE, subrounded pebbles to 2" diameter	
205		22	12	As above, pebbly to Gravelly SAND(or thinly interbedded GRAVEL, SAND, and SILT with subhorizontal bedding)	
		20	12	As above	
210		19	8		Drilled to clean out hole: 211.5-212.5'
		18	5		
215		16	8	Gravelly SAND	
		16	10		
		6	5		
220		0	5	Tried to core again 3" no recovery, drilled to 222-1/2' with rock bit	
				Hard	
		19	7	Sandy GRAVEL and fine Sandy CLAY or SILT-2nd foot	
225		30	10	Silty CLAY, hard	
		28	10	As above with fine SAND / Sandstone structure	
230					

TERRASEARCH INC. FIGURE NO.

LOGGED BY DB DATE DRILLED 5/15-27/92 BORING DIAMETER 3" core BORING NO. 41

Depth ft.	Coring Interval	Recovery (in.)	Coring time (minutes)	SOIL DESCRIPTION	REMARKS
		25	10	Blue grey Silty CLAY, hard, moist, dense, massive structure, irregular surfaces in induced core fractures(breaking apart by hand).	
		23	9		
235		24	9	As above with fine Sand, top 3" softened with drill fluid-discarded	
		14	8	Grades to?-Blue grey Clayey fine SAND, very dense, moist, massive, rough surface(when broken by hand)	
240		30	9	More Clayey, grades? to	
				CLAY	
		24	9	As above, irregular fracture Grades? to	
245		23	8	SAND Blue grey Clayey fine SAND, dense, hard to break, irregular fracture	
		17	8	Sandier, slightly easier to break	
250		31	7	As above with calcareous spots	
		19	?		
255		21	9	Blue grey Clayey fine SAND, slightly moist, extremely dense, rough fracture(BBP) calcareous spots	wrapped at 257.0-257.5'
		29	9		
260				BORING TERMINATED AT 260'.	

TERRASEARCH INC. FIGURE NO.

LOGGED BY R.R. DATE DRILLED 6/9-11/92 BORING DIAMETER 3" core BORING NO. 42

Depth ft.	Coring Interval	Recovery (in.)	Coring time (minutes)	Located 150' East of Panch Road SOIL DESCRIPTION	REMARKS
				Light brown pebbly Siltv CLAY	
5					
				—as above, grading mottled red brown w/ scattered gravels	
10					
15					
				—mottled red brown Pebbly Silty CLAY	
20					
				—firmer at 22', light/medium brown	
				Mottled red brown/blue grey/tan Pebbly Silty CLAY w/angular to well rounded Pebbles to 1-1/2": chaotic texture, varied zones	
25					
		30	4	—45 degree shear @ 26.7'	wrapped
		27	5		
30				—5" well rounded cobble	

TERRASEARCH INC. FIGURE NO.

LOGGED BY RR DATE DRILLED 6/9-11/92 BORING DIAMETER 3" core BORING NO. 42

Depth ft.	Coring Interval	Recovery (in.)	Coring time (minutes)	SOIL DESCRIPTION	REMARKS
		30	6	Zone of very dark brown matrix Clayey SAND w/ Gravel to 6".	
		24	4	Dense Sandy Clayey GRAVEL w/pods of loose pea gravel	
35		12	3	Loose GRAVEL, 1/8" to 1-1/4" (some slough?)	Drilled out Gravel at 36-39.5'
				1" Gravel 1" thick medium/dark grey Clay layer (Base Qlr?) at contact	
40		21	5	Finely laminated tan/black Silty very fine SAND and Sandy SILT, black carbonaceous laminae may produce black "oil" scum in drilling mud	(wrapped)
		4	6	—dark grey Clayey SILT	
45		15	10	Mottled tan/dark grey Clayey Pebbly SILT: angular clasts dark grey Shale, brecciated texture; angular clasts to 3", vertical fracture in Siltstone	Gravel sloughing on top of sampler
		17	3		
		12	3		
		12	3		
50				Gravelly SAND & Sandy GRAVEL, some broken well-rounded cobbles to 6" diameter	drilled out and grouted at 50.5' to 51.0'
		23	5	Chaotic mixture of grey black Clay & Silt, light olive Sand and rounded Pebbles (laminae juxtaposed by fractures)	
		16	4	—as above, top of old Slide Debris?	
55					
		12	7	Very dark grey Gravelly CLAY; bottom 4" calcite-cemented w/brecciated texture; hard coring (old slide debris)	
		12	6		
60					

TERRASEARCH INC. FIGURE NO.

LOGGED BY RR DATE DRILLED 6/9-11/92 BORING DIAMETER 3" core BORING NO. 42

Depth ft.	Coring Interval	Recovery (in.)	Coring time (minutes)	SOIL DESCRIPTION	REMARKS
		18	3	—as above (interbedded Gravelly Clay & Clayey Gravel (SLIDE DEBRIS)	Fluid loss @ 61'
		21	13	—as above (SLIDE DEBRIS)	
65		14	15		
		15	10	—as above (angular fragments dark grey Siltstone in very dark grey Clay matrix: OLD SLIDE DEBRIS	
70		14	10		
		17	16	—as above, very dark grey Gravelly CLAY (OLD SLIDE DEBRIS)	
75		18	10		
		14	10		
		16	4		
80		21	14		at 80' changed to narrower sampler to try to improve recovery
		30	14		
85		0	10		
				Apparently unsheared contact at 88.2'	(?base of old slide?)
		18	3	Blue grey Pebbly SANDSTONE	
90		18	12	Blue green Silty CLAY w/khaki mottling· abundant white Caliche seams and nodules	

TERRASEARCH INC. FIGURE NO.

LOGGED BY RR DATE DRILLED 6-9/11/92 BORING DIAMETER 3" core BORING NO. 42

Depth ft.	Coring Interval	Recovery (in.)	Coring time (minutes)	SOIL DESCRIPTION	REMARKS
		18	10	Mottled blue grey green fine Sandy Clayey SILTSTONE, caliche vein undulating @ low angle, hint of disturbed bedding	
		11	15	Blue grey fine Sandy CLAY, massive	
		0	17	No recovery, plugged up around outside of core barrel	
95					Change to Pitcher Tube
		18	2	Blue grey green fine SAND, rounded grains, clean quartz Sand; Gravel lens at 96.5'	
		30	3		
100		30	2		
				—as above, but with 2 clay seams top 1" thick bedding inclined about 15 degrees	
		30	1 min 10 sec		
105				—as above with coarser Sand	
		24	1 min 10 sec		
		12	5	—as above, coarse Sand w/shale fragments derived from Cretaceous	
110		13	5		
				—as above with more rock fragments	
		6	4		
115					

Coring terminated at 116.5'

NOTE: Put piezometer in hole; 120' of 1" pipe, bottom 30' slotted, 40' sand with betonite pellets on top; backfill annulas with cutiings.

LOGGED BY DB DATE DRILLED 6/26/92 BORING DIAMETER 5" BORING NO. 43

Depth ft.	Coring Interval	Recovery (in.)	Coring time (minutes)	SOIL DESCRIPTION	REMARKS
5					
				Brown cuttings clay & sand	
10					
15					
20				Start coring at 20'	
	X	21	4	Dark yellowish brown (10YR 4/6, wet) Clayey GRAVEL/Gravelly CLAY	
	X	.7	4		
25	X	19	3		
	X	4	4	lost drill fluid during run from 27.5-30, w/ Tri-cone bit to 30', still losing fluid after drilling	
30					

TERRASEARCH INC. FIGURE NO.

LOGGED BY DB DATE DRILLED 6/29/92 BORING DIAMETER 5" BORING NO. 43

Depth ft.	Coring Interval	Recovery (in.)	Coring time (minutes)	SOIL DESCRIPTION	REMARKS
				Came back 1 hr later, tried more bentonite/cement cement still losing water, hit hard spot w/core 30-30.2' Drilled 30.2 to 32.5	
		16	4	As above, lighter brown	Start 6/29
35		18	4	As above, uncemented, darker brown	
		13	5	As above	
40		9	6	As above	
		7	6	hard spot, drill out w/bit, get more water	
45		6	6	As above	
		8	8	As above, grey green mottles	
50		18	8	As above, darker grey Gravelly Clay, wrapped from 51-52'	
		12	5	Greenish grey (5BG 5/1, wet) Silty CLAY w/ subhorizontal laminae	
55		23	7		
		26	6	As above w/fine Sandy Clay layer and (calcite cemented chunks of sand w/cavities)	
		14	5	As above w/Sand and some Gravel, subrounded pebbles of dark grey chert	
60					

TERRASEARCH INC. FIGURE NO.

LOGGED BY DB DATE DRILLED 6/26/92 BORING DIAMETER 5" BORING NO. 43

Depth ft.	Coring Interval	Recovery (in.)	Coring time (minutes)	SOIL DESCRIPTION	REMARKS
		21	5	Greyish green Gravelly SAND, subrounded subangular clasts of various types of incl. Sandstone	
		6	5		
65					
		8	5		
		4	6		
		16	10	As above	
70					
		12	10	Very Gravelly - cobbles	
				As above	
		3	9		
75					
		10	10		
				Boring terminated at 77 feet.	

LOGGED BY DB DATE DRILLED 6/22/92 BORING DIAMETER 5" BORING NO. 44

Depth ft.	Coring Interval	Recovery (in.)	Coring time (minutes)	SOIL DESCRIPTION	REMARKS
5					
10		25	3		
		24	2.5		
15		23	4	Slickensided shear-high angle at approximately 15' red zone at 14-15', wrapped, got 16-17, red @ 15-15.2, iron stained 15.2-16.5	transverse (horizontal) undulating slickensides
		6	5		
		12	10	Cutting gravel at 19'	
20		12	11	As above	
				As above, uncemented	
		20	5		
				As above	
25		16	7		
		21	5	As above	
		21	3	As above	
30					

TERRASEARCH INC. FIGURE NO.

LOGGED BY DB DATE DRILLED 6/22/ 23 BORING DIAMETER 5" BORING NO. 44

Depth ft.	Coring Interval	Recovery (in.)	Coring time (minutes)	SOIL DESCRIPTION	REMARKS
		21	4	As above	
		29	2	Brown medium grained to coarse SAND w/small Clay pocket	
35		28	2.5	As above w/horizontal laminae 36.5-38.0'	
		30	3	As above	
40		26	3	As above w/subhorizontal laminae approx. 10 deg.	
		16	3	Coarse SAND	
45		17	4	Olive (5Y 5/4, wet) Silty fine SAND with carbonaceous? laminae, subhorizontal to horizontal carbon disciminated in sample approx. 48-1/2 to 50'	
		26	4		
50		24	4	As above w/orangish brown oxidized feature at 52' (Sample 50-52.5 put in plastic bag)	light  dark
		21	3	Dark greenish grey (5G 4/1, wet) fine Sandy CLAY, massive	
55		21	4	Grades to	
				Fine Silty SAND	
		31	4		
60				Boring terminated at 60 feet.	

TERRASEARCH INC. FIGURE NO.

LOGGED BY DB DATE DRILLED 6/24/92 BORING DIAMETER 5" BORING NO. 45

Depth ft.	Coring Interval	Recovery (in.)	Coring time (minutes)	SOIL DESCRIPTION	REMARKS
5					
10					
15					
20	X	10	3.5	Start coring at 20' Brown (10YR 5/3, wet) Silty CLAY w/Sand (shale clast stuck in bottom of tube)	
	X	29	2.5	Pale olive (5Y 6/4, wet) and yellowish brown (10YR 5/6) slightly Silty SAND fine-grained with sub-horizontal laminae and caliche; vertical caliche at 22'	
25	X	29	2		
	X	31	3		
30					

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FIGURE NO.

LOGGED BY DE DATE DRILLED 6/24/92 BORING DIAMETER 5" BORING NO. 45

Depth ft.	Coring Interval	Recovery (in.)	Coring time (minutes)	SOIL DESCRIPTION	REMARKS
		24	3		
				Coarse thin layer @ 33'	
		29	5	Greenish grey (5BG, 5/1, wet) Silty CLAY, massive, homogeneous	sharp, wavy contact
35					
		33	4.5	horizontal varves (?) at 39-39.5'	
40					
		32	3	Pale olive Sandy CLAY/Clayey fine SAND	very wavy contact, some yellow brown stain
				Grades to greenish grey, massive, homogeneous Silty CLAY w/trace horizontal varves	
		33	3	As above approx. 3/8 varves based on ripple pattern produced by Pitcher Tube coring	
45					
		29	2	Pale olive Clayey SAND w/steeply dipping yellow brown staining (along fractures?)	
		22	4	Greenish grey, massive, homogeneous fine Sandy CLAY/Clayey fine SAND	
				As above	
50					
		29	5	As above, slightly lighter color, very dense, hard	
		27	12	Hard cemented "sandstone" stuck in tip of barrel	
55					
		11	10	As above	
		33	9		
60					
				Boring terminated at 60 feet. Dry at time of drilling.	

LOGGED BY DB DATE DRILLED 6/12/92 BORING DIAMETER 5" BORING NO. 46

Depth ft.	Coring Interval	Recovery (in.)	Coring time (minutes)	SOIL DESCRIPTION	REMARKS
5					
10					
15				Rocky at 15'	
				Reddish brown Sandy CLAY w/Gravel, Sandstone fragment fell in hole, massive, dense	Started coring at 16.5'
		8	2	switch to modified Cal sampler	
20		NR	1	1-2" gravel blocked sampler	
		NR	3	No recovery in Mod. Cal, re-sampled w/Pitcher tube, large diameter gravel prevents recovery-cannot get large rocks out of hole	
		NR		Push tube	
25		NR	3	Very rocky, drilling fluid starts to come out of crack in ground 4' from hole, rock splits Pitcher Barrel-rounded hard Sandstone cobble	
		12	2	Coarse Gravel-cobbles	
		19	5		
30				Back into brown Sandy CLAY :grey shale fragments trace carbonaceous laminae	

TERRASEARCH INC. FIGURE NO.

LOGGED BY RR DATE DRILLED 6/12/92 BORING DIAMETER 3" core BORING NO. 46

Depth ft.	Coring Interval	Recovery (in.)	Coring time (minutes)	SOIL DESCRIPTION	REMARKS
		19	5	Well rounded GRAVEL to 3"; top 6"=Clayey Sand mastrix	
		21	3	Mottled brown Pebbly Sandy CLAY As above	
35					
		13	3.5	As above	
		24	1.5	As above	
40		18	2	As above	
		20	3	As above	
		18	2	As above w/pod Sand @ 44.7-45.1 (bottom contact wrapped)	
		15	2		
45					
		19	1.5	Irregular contact (wrapped)	
		14	1	Angular clasts SILTSTONE & fine grained black-laminated Sandstone, chaotic mixture of light red brown Gravelly SAND/brownish black Gravelly Clay and dark blue pods Gravelly Clay	
		12	1		
50				1/8" to 1/16" very dark grey CLAY seam @ contact	49.7 (wrapped)
		16	3.5	Mottled grey black/blue green SAND/GRAVEL/CLAY; brecciated texture (old slide debris); finely disseminated mineralization (pyrite & bright green mineral)	
		14	0.5		
		19	5	Loose mixture of dark grey and dark blue green coarse Sand and pea Gravel with subhorizontal interbeds of fine Silty SAND	
55		4	6.5	Cobble pushed core out of way: 55.0-56.5'	
		20	2	Interbedded fine Silty SAND & coarse Pebbly SAND	
		13	6	Dark blue grey to blue green Gravelly Clayey SAND w/brecciated texture (old slide debris)	
60				Boring terminated at 60 feet. Dry at time of drilling (bailed hole; dry 24 hours later).	

TERRASEARCH INC. FIGURE NO.

LOGGED BY RR DATE DRILLED 6/16/92 BORING DIAMETER 3" core BORING NO. 47

Depth ft.	Coring Interval	Recovery (in.)	Coring time (minutes)	SOIL DESCRIPTION	REMARKS
				Medium brown Pebbly Clayey SILT & Silty CLAY	
5					
					Started coring at 10.0 feet
				Mottled medium brown/red brown Pebbly Silty CLAY: angular fragments dark grey Claystone in Silty Clay matrix (slide debris)	
10		18	8		
		18	2	6" fragment as above (slide debris)	
		18	1.5	Angular clasts fractured SHALE (dark grey Claystone) to 6"	
15		18	1.5	Polished irregular 20 deg. shears Pebbly Silty CLAY, as above	
		17	1.5		
		19	2	20 deg. shear	
20		18	1.5	10 deg. shear	
		18	4		
		18	1.1	Pebbly Silty CLAY, as above	
		18	3		
25		18	4	25 deg. shear 6" Shale fragment	
		17	2		
		19	3		
30		17	3	Irregular, non-sheared basal contact at 30.3'	
				@30.8': planar, granulated (non-clayey) shear dipping 30 deg. (wrapped)	

TERRASEARCH INC. FIGURE NO.

LOGGED BY RR DATE DRILLED 6/16/92 BORING DIAMETER 3" core BORING NO. 47

Depth ft.	Coring Interval	Recovery (in.)	Coring time (minutes)	SOIL DESCRIPTION	REMARKS
		18	3	Light to medium-green, fine-grained, soft, sheared Serpentinous talc planar 25 deg lower sheared contact (wrapped)	
		18	2	Vari-colored chaotic sheared melange of Sandstone, talc, Clay & Claystone	
35		16	0.3	Interbedded, loose, coarse Pebbly SAND and fine Silty SAND; bedding appears subhorizontal and undisturbed	
		12	0.5		
		16	3		
		12	6	Mottled red brown w/caliche specks Gravelly Clayey SAND, harder, conglomeratic or chaotic texture	
40		12	9	As above No recovery (sampler tube blocked by cobble)	Bottom of Qlo?
		NR	5	Red brown Clayey SILT, soft, massive	
45		24	4	Light grey brown Clayey SILT	
		25	4	Light red brown to light grey brown SILT w/ zones of very fine Sand As above	
		26	2		
50				1" lens light grey CLAY at 51'	
		24.5	4		
		25	3	Light grey w/red brown mottling Silty CLAY w/isolated pebbles	
55		27	3	As above w/vertical iron-stained joint from 55-56'	
		26	3	As above, gradational color change to mostly blue grey w/red brown mottling	
		27	3	As above	
60					
				Boring terminated at 60 feet. Dry at time of drilling. Water at 58' after 24 hours	

TERRASEARCH INC. FIGURE NO.

LOGGED BY RR DATE DRILLED 6/16-17/92 & 6/30/92 BORING DIAMETER 3" core BORING NO. 48

Depth ft.	Coring Interval	Recovery (in.)	Coring time (minutes)	SOIL DESCRIPTION	REMARKS
		24	6	Uniform fine Sand 60-62'	
		21	2	As above, planar contact between fine & coarse SAND at 64'	
65		20	14	Chaotic texture; angular clasts black CLAY to 1" in disturbed matrix (mobilized zone of Qlo)	
		8	7		
		14	9	As above (blue grey Gravelly SAND w/chaotic texture)	
		18	20	As above (subrounded fragments or "clasts" to 2" diameter)	
70					Cored to 74.4 on 6/17/92
		14	11	As above, but very hard cemented zone	
		8	10		
		21	6	As above w/10" piece of wood in center (wrapped)	Re-entered hole on 6/30/92; cleaned and washed out to 77.0'
75				Greyish green Gravelly SAND; chaotic mobilized texture; angular clasts soft black Clay to 3/4"	
		15	10	As above	
80		24	10	Greyish green Clayey fine SAND/Sandy CLAY	
				(rounded chert cobble lodged in tube)	
		NR			Reamed hole to 86 for alignment
85		8	10	Clean SAND, fine to medium grained	
		24	5	Greyish green SAND	
		30	6	Poorly sorted; clean, subrounded, fine grains	
90					

LOGGED BY DB/RR DATE DRILLED 6/30 & 7/1/92 BORING DIAMETER 5" BORING NO. 48

Depth ft.	Coring Interval	Recovery (in.)	Coring time (minutes)	SOIL DESCRIPTION	REMARKS
		30	6	As above	
		8	8	hard silica-cemented(?) piece of greenish grey SANDSTONE	
95		16	15	As above (clayey from 95-96')	
		29	10	Blue grey Clayey Silty very fine to fine-grained SAND with finely disseminated pyrite; 1/16" dark grey planar seam dipping 20 degrees at 98', no evidence of shearing when broken apart by hand (apparently bedding)	
100		24	?	As above	
		23	15	SAND, more Clayey in bottom 6 inches	

Boring terminated at 104 feet.

TERRASEARCH inc. FIGURE NO.

LOGGED BY DB/RR DATE DRILLED 6/18/92 BORING DIAMETER 3" core BORING NO. 49

Depth ft.	Coring Interval	Recovery (in.)	Coring time (minutes)	SOIL DESCRIPTION	REMARKS
				Medium brown Pebbly Clayey SILT	
5					
10				Mottled red brown Clayey Gravelly SAND; well rounded cobbles to 6"	
	X	11	5		
	X	17	4	As above, grading denser	
	X	30	3	As above	
15					
	X	18	2	As above	
	X	30	2	As above	
20					
	X	18	3	Mottled tan/red brown Clayey SILT and very fine Silty SAND Mottled orange brown Silty SAND or SANDSTONE	
	X	24	3	Some rounded Pebbles of various lithologies, some are angular, various size, appears to be an agglomerate?	
25	X	24	2		
	X	24	2.3	As above	
	X	22	7	As above	
30					

TERRASEARCH INC. FIGURE NO.

LOGGED BY DB DATE DRILLED 6/19/92 BORING DIAMETER 5" BORING NO. 49

Depth ft.	Recovery (in.)	Coring time (minutes)	SOIL DESCRIPTION	REMARKS
	13	5		
35	11	5	As above, larger rock fragments	
	8	7	As above	
	24	6	As above, but looser, falls apart, more orange and some yellow color	
40	18	9	41-43.5' wrapped in tray	
	26	7	Bottom of agglomerate	
			Transition soil?	
45	30	1.7	Dark greenish grey (5BG, 4/1) Silty CLAY Fine Sandy Clay @ 46''	
	18	8	Back into orange brown agglomerate	wrapped contact
50	20	7	As above	
	20	2.5		
	12	8	As above	
	8	11		
55	14	18	As above	
	18	18		
	6	11		
60	18	18		

TERRASEARCH inc. FIGURE NO.

LOGGED BY DB	DATE DRILLED 6/19/92	BORING DIAMETER 5"	BORING NO. 49

Depth ft.	Coring Interval	Recovery (in.)	Coring time (minutes)	SOIL DESCRIPTION	REMARKS
		9	16	As above	
		12	11		
		8	10		
65		6	16		
		6	14	Transition-Greenish grey SAND and yellowish brown agglomerate	
		8	6		
		33	4	Greenish grey fine Sandy SILT/SILTSTONE?	
70				As above, grades to Silty fine SAND/SANDSTONE	
		32	3.5		
				Boring terminated at 73 feet. Dry at time of drilling.	

TERRASEARCH INC. FIGURE NO.

LOGGED BY DB DATE DRILLED 6/23/92 BORING DIAMETER 5" BORING NO. 50

Depth ft.	Coring Interval	Recovery (in.)	Coring time (minutes)	SOIL DESCRIPTION	REMARKS
				(1-10' not logged)	
5					
10				Yellow brown Clayey Gravelly SAND/GRAVEL	
		24	3		
		23	2	Reddish @ 12.5-13'	
				Mottled tan and orange Gravelly SAND	
15		21	8	As above, Sandstone and shale fragments are highly weathered & orange brown stained	
		22	2	As above	
		19	7		
20				As above	
		12	3	As. above	
		14	7		
25		12	15	As above, more gravel and cobbles Mottled tan and brown color	
		16	12	As above, deeply weathered clasts	
		12	10	As above, cobbly	
30					

TERRASEARCH INC. FIGURE NO.

LOGGED BY DB DATE DRILLED 6/23, 24 BORING DIAMETER 5" BORING NO. 50

Depth ft.	Coring Interval	Recovery (in.)	Coring time (minutes)	SOIL DESCRIPTION	REMARKS
		10	7		
		12	4		
			10	Cored into grey crystalline rock w/partial orange	
35			15	brown coating about approx. 1/32 inch thick	start 6/24/92
		10	10	As above, cobbly, rounded, deeply weathered clasts	
		14	7	As above	
40		9	11		
		15	14	As above	
		22	11	As above	
45		6	26	Fairly rough planar contact	
		23	4	Olive (5Y 5/4, wet) w/brownish yellow (10YR 6/8, wet) mottles, approx. (horizontal & vertical mottles) fine Sandy SILT	
50		31	3.5	Dark greenish grey fine Sandy SILT, massive, homogeneous Back into olive last 3"-low-angle (20 deg), contact w/dark green grey	
				Boring terminated at 50.5 feet. Dry at time of drilling.	

TERRASEARCH INC. FIGURE NO.

LOGGED BY RR DATE DRILLED 6/8/92 BORING DIAMETER 3" core BORING NO. 51

Depth ft.	Coring Interval	Recovery (in.)	Coring time (minutes)	SOIL DESCRIPTION	REMARKS
				Medium brown Pebbly Clayey SILT	
5		26	3	Medium brown Pebbly Clayey SILT and Silty CLAY; angular pebbles to 1/2" brecciated texture (slide debris)	
		27	3	As above w/shear at 9.6' (flat) (wrapped)	
10		26	6	As above w/6" cobble @ 11.5'; gravelly below 11.5'	
		30	7	As above less gravelly below 13'	
15		26.5	7	As above, grades denser and less pebbly 16.3 to 17.8'	
		31	8	As above	
20		30	4		
		30	3	Pebbles to 4" diameter	
25				Grading red brown	
		12	4	6" cobble @ bottom of run (27')	
		19	10	Gravelly @ 27' and 29'; 1" clay layer @ 28.5' (wrapped), depositional contact at 29.4'	
30		29	5		

TERRASEARCH inc.

FIGURE NO.

LOGGED BY RR DATE DRILLED 6/8/92 BORING DIAMETER 3" core BORING NO. 51

Depth ft.	Coring Interval	Recovery (in.)	Coring time (minutes)	SOIL DESCRIPTION	REMARKS
		29	5	Mottled grey brown w/light red brown seams Clayey SILT Pebbly layer @ 31.4-31.8'	
		33	5	Numerous irregular nodules calcium carbonate	
35		19	5	Gravelly @ 34.3 and 36.4'	
		25	7	Interbedded Clayey SILT & very fine SAND w/ scattered well rounded Pebbles to 3" diameter; some steeply veins of calcium carbonate	drilled out cobble 39.0-39.5'
40		NR	5	(rock pushed ahead of tube)	
		NR	3	(rock pushed ahead of tube)	
				Boring terminated at 44 feet. Dry at time of drilling.	

TERRASEARCH inc. FIGURE NO.

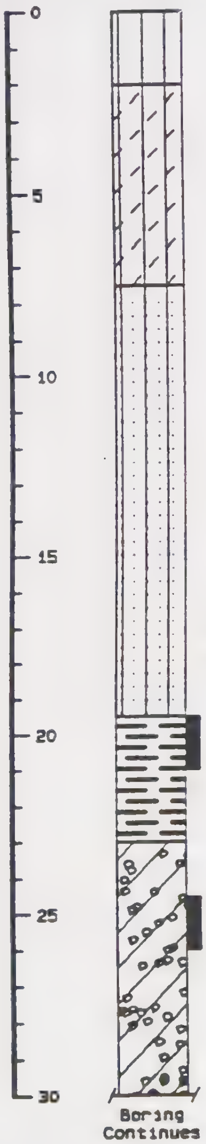
LOG OF TEST BORING

BORING 52

Boring No: 52
Date Drilled: 9-17-92
Elevation: N/A
Logged by: AR

Project No: 5541

Water Level: 62'(drilling)   After: 105'



ELEV / DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS	USCS	SOIL DESCRIPTION	REMARKS	Sample No.	Blows foot	Density Dry-pcf	Moisture Percent
			Very light grey brown pebbly SILT, dry, loose	2.5" dia. samples except where noted				
			Medium/light brown pebbly Clayey SILT, slightly moist					
			Light red brown pebbly Clayey Sandy SILT, with scattered Gravel					
			? BASE Qlr?					
			Grades more greyish tint					
			Medium brown to grey brown brecciated SILTSTONE (appears Kp derived- shoe looked undisturbed, with 45 degree dip in bedding)		52-1	37		
			Dark brown pebbly to Gravelly CLAY and Clayey SILT, with clasts Kp Siltstone in Clayey matrix (slide debris)		52-2	27		

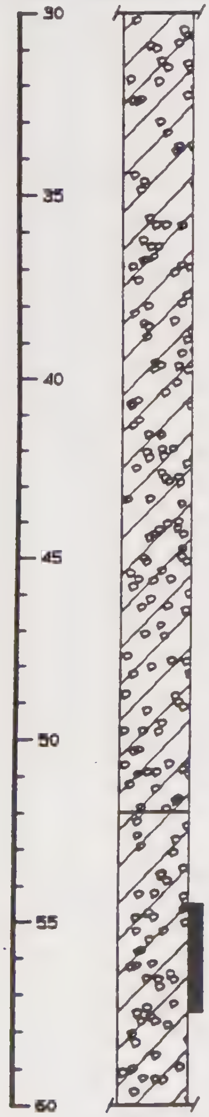
Figure Number

LOG OF TEST BORING

BORING 52

Boring No: 52 Project No: 5541
Date Drilled: 9-17-92
Elevation: N/A
Logged by: RR

Water Level: 62' (drilling) After: 105'



Boring Continues

ELEV / DEPTH	SOIL SYMBOLS / SAMPLER SYMBOLS	USCS	SOIL DESCRIPTION	REMARKS	Sample No.	Blows foot	Density Dry-pcf	Moisture Percent
			As above					
			Dark grey pebbly to Gravelly CLAY with Gravelly zones of hard metamorphic rock (slide debris)		52-3	34		
			Dark brown pebbly CLAY, with specks of red Siltstone	Perched water @ 54 (wet spots)	52-4	39		

Figure Number

TERRASEARCH, Inc.

LOG OF TEST BORING

BORING 52

Boring No: 52

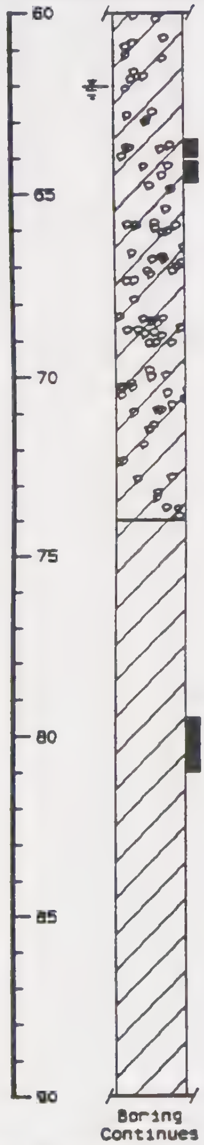
Project No: 5541

Date Drilled: 9-17-92

Elevation: N/A

Logged by: RR

Water Level: 62'(drilling) After: 105'



Water Checked 105'

ELEV / DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS	USCS	SOIL DESCRIPTION	REMARKS	Sample No.	Blows foot	Density Dry-pcf	Moisture Percent
					52-5b 52-5a	68		
			Mottled dark brown pebbly CLAY, with wet spots, slide debris					
			Dark greyish brown pebbly CLAY, moist, very stiff					
			Color change to very dark grey					
					52-6	44		
			Very dark grey pebbly CLAY, brecciated texture (slide debris) moist, dense, stiff					

Figure Number

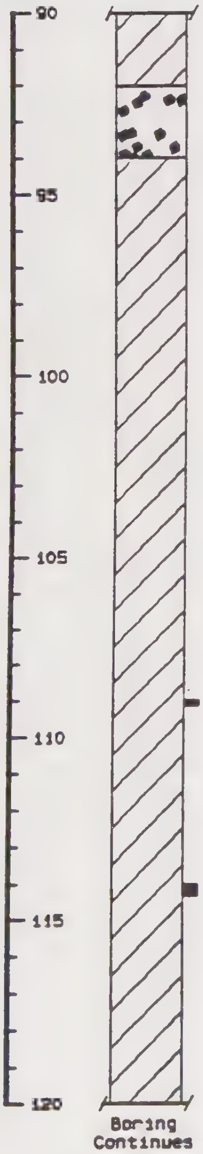
TERRASEARCH, Inc.

LOG OF TEST BORING

BORING 52

Boring No: 52 — Project No: 5541
Date Drilled: 9-17-92
Elevation: N/A
Logged by: RR

Water Level: 62' (drilling) — After: 105'



ELEV / DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS	USCS	SOIL DESCRIPTION	REMARKS	Sample No.	Blows foot	Density Dry-pcf	Moisture Percent
			Hard Gravelly zones					
			Very dark grey pebbly CLAY, brecciated texture (slide debris) moist, dense, stiff					
			Water @ 105' (inside hollow-stem) @ 8 a.m. 9-18-92					
			Boulder? chaotic texture some Clay matrix; (light blue grey cemented very-fine-grained Sandstone boulder)	dis-turbed sample	52-7	60/2"		
			Very dark grey and dark blue-green pebbly SAND and SILT, chaotic texture	2" dia. sample	52-8	70/4"		

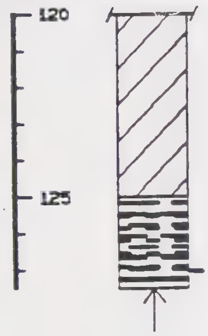
Figure Number

LOG OF TEST BORING

BORING 52

Boring No: 52 | Project No: 5541
Date Drilled: 9-17-92
Elevation: N/A
Logged by: RR

Water Level: 62'(drilling) After: 105'



ELEV / DEPTH	SOIL SYMBOLS / SAMPLER SYMBOLS	USCS	SOIL DESCRIPTION	REMARKS	Sample No.	Blows foot	Density Dry-pcf	Moisture Percent
			Sharp increase in hardness					
125			Very hard cemented pebbly SANDSTONE and SILTSTONE, medium grey. (Cret. bedrock)	Terz. sampler	52-9	60/1"		
			Drilling refusal at 127.5'. PIEZOMETER INFORMATION: Set upper piezometer 40' to 64' (bottom 10' slotted) Set lower piezometer 72' to 128' (bottom 10' slotted) PIEZOMETER WATER LEVELS: 9-21-92: 54.5' & 126' 9-26-92: 48' & 125'					

Figure Number

LOG OF TEST BORING

BORING 53

Boring No: 53
Date Drilled: 9-18-92
Elevation: N/A
Logged by: RR

Project No: 5541

Water Level: N/A

After: N/A

ELEV / DEPTH	SOIL SYMBOLS / SAMPLER SYMBOLS	USCS	SOIL DESCRIPTION	REMARKS	Sample No.	Blows foot	Density Dry-pcf	Moisture Percent
0			Medium brown pebbly Clayey SILT, slightly moist					
7			DArk brown pebbly Silty CLAY					
26.5			Fine GRAVEL, loose, medium grey brown					
29.5			Medium/dark brown pebbly Silty CLAY					

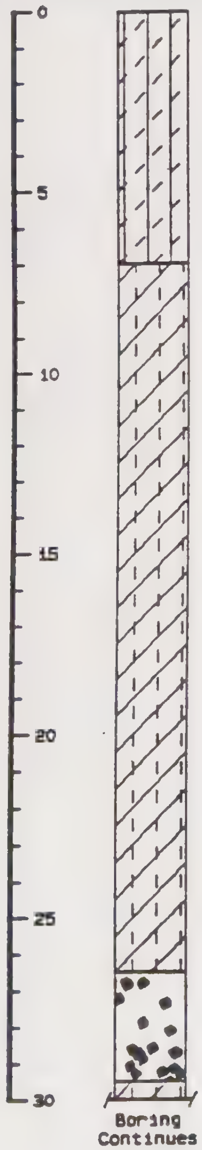


Figure Number

TERRASEARCH, Inc.

LOG OF TEST BORING

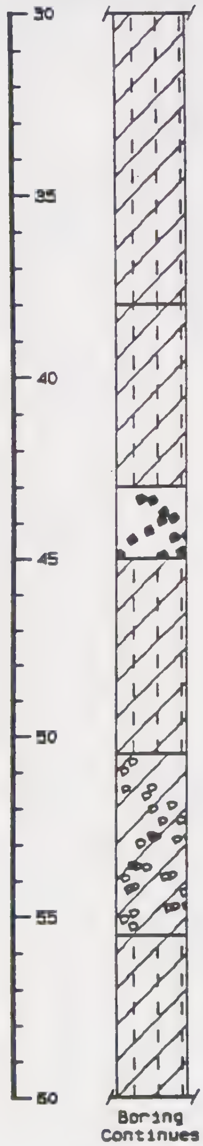
BORING 53

Boring No: 53
Date Drilled: 9-18-92
Elevation: N/A
Logged by: RR

Project No: 5541

Water Level: N/A

After: N/A



ELEV / DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS	USCS	SOIL DESCRIPTION	REMARKS	Sample No.	Blows foot	Density Dry-pcf	Moisture Percent
			Very dark brown pebbly Silty CLAY					
			GRAVEL					
			Very dark brown pebbly Silty CLAY					
			Dark brown Gravelly CLAY and Clayey GRAVEL					
			Dark grey brown Silty CLAY					

Figure Number

LOG OF TEST BORING

BORING 53

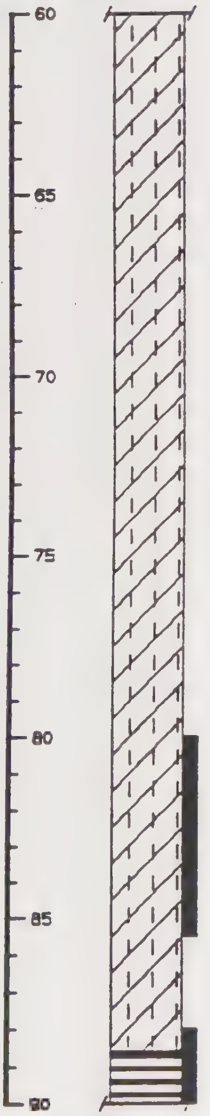
Boring No: 53 | Project No: 5541

Date Drilled: 9-18-92

Elevation: N/A

Logged by: RR

Water Level: N/A | After: N/A

ELEV / DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS	USCS	SOIL DESCRIPTION	REMARKS	Sample No.	Blows foot	Density Dry-pcf	Moisture Percent
60–90			Dark grey pebbly Silty CLAY (slide debris)					
			Very dark grey pebbly CLAY (slide debris) angular clasts Claystone in stiff Clay matrix	Mostly plug weekend satu-ration	53-1 53-2 53-3	25 72 14		
			As above, brecciated texture		53-4	53		
			As above, but light green serpentinous material in shoe	Incom. sample	53-5 53-6	55 50/1"		
			As above, with serpentine pod in shoe	Drilled 85.5 to 88'				
			Hard cemented GRAVEL with finely granular serpentine	Slide Plane @88.7'	53-7	45		
			Hard drilling with soft streaks		53-8	51		
			Olive green/khaki w/blue green mottling Silty CLAYSTONE w/ blue grey Sandstone clasts					

Boring Continues

Figure Number J

LOG OF TEST BORING

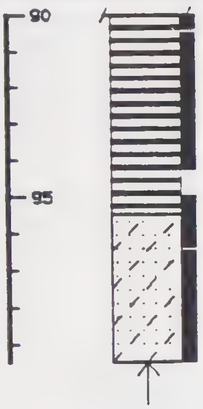
BORING 53

Boring No: 53
Date Drilled: 9-18-92
Elevation: N/A
Logged by: RR

Project No: 5541

Water Level: N/A

After: N/A



ELEV / DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS	USCS	SOIL DESCRIPTION	REMARKS	Sample No.	Blows foot	Density Dry-pcf	Moisture Percent
			As above, but grading mostly blue-grey with more Sand and caliche seams		53-9	42		
					53-10	33		
					53-11	79		
			Blue grey Clayey SAND with Clayey pods and caliche nodules	Drilled 94.3 to 95.0'	53-12	52		
					53-13	46		
					53-14	53		
			Boring terminated at 99.5'. Groundwater at 40'. " " 39.8' on 10-7-92 Piezometer hole drilled 10' to south: drilled to 55'; pipe set at 52'; open from 3' to 52'; bottom 10' slotted. PIEZOMETER WATER LEVELS: 9-28-92: 39' 10-7-92: 39.3'					

Figure Number

TERRASEARCH, Inc.

LOG OF TEST BORING

BORING 54

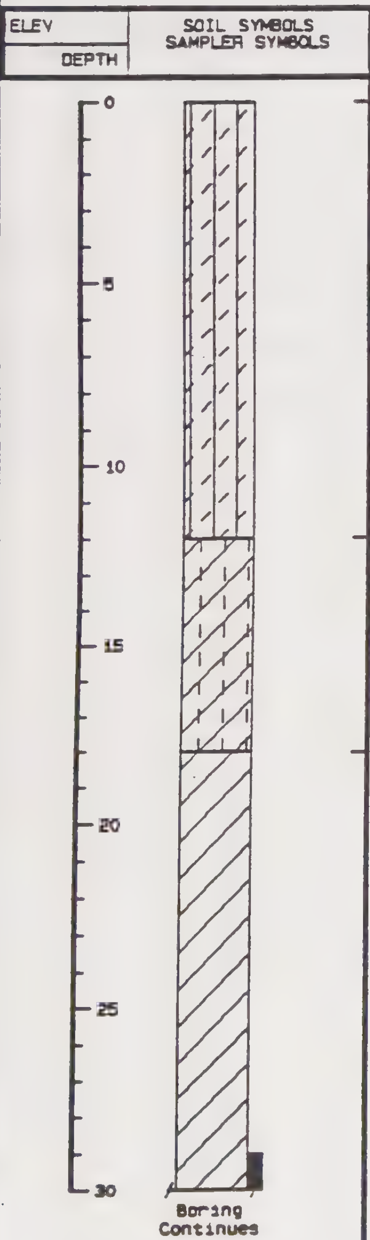
Boring No: 54 | Project No: 5541

Date Drilled: 9-23-92

Elevation: N/A

Logged by: RR

Water Level: 40' | After: 40'



USCS	SOIL DESCRIPTION	REMARKS	Sample No.	Blows foot	Density Dry-pcf	Moisture Percent
	Medium brown pebbly Clayey SILT, dry grading to slightly moist					
	With reddish brown zones					
	Medium grey brown pebbly to Gravelly Silty CLAY and Clayey SILT with streaks Gravel					
	Light brown pebbly CLAY, grading to grey brown					
	Khaki and olive drab with blue grey mottling pebbly Silty CLAY, dense, stiff, moist		54-1	36		

Figure Number -

TERRASEARCH, Inc.

LOG OF TEST BORING

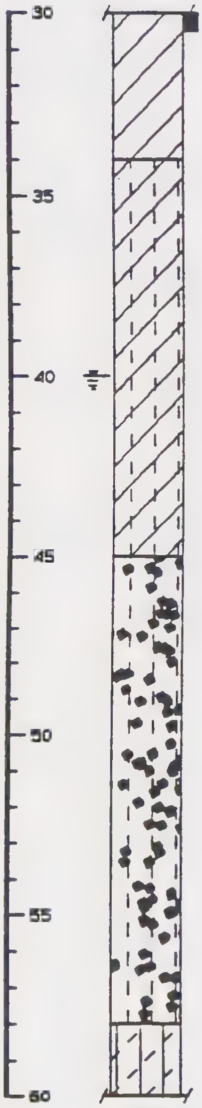
BORING 54

Boring No: 54
Date Drilled: 9-23-92
Elevation: N/A
Logged by: RR

Project No: 5541

Water Level: 40'

After: 40'

ELEV / DEPTH	SOIL SYMBOLS / SAMPLER SYMBOLS	USCS	SOIL DESCRIPTION	REMARKS	Sample No.	Blows foot	Density Dry-pcf	Moisture Percent
								
			Blue grey Silty CLAY with scattered pebbles					
			Light blue grey Clayey Silty GRAVEL with rounded pebbles to 1 1/2" dia.					
			Blue grey pebbly Clayey SILT					

Boring Continues

Water Checked 40'

Figure Number

TERRASEARCH, Inc.

LOG OF TEST BORING

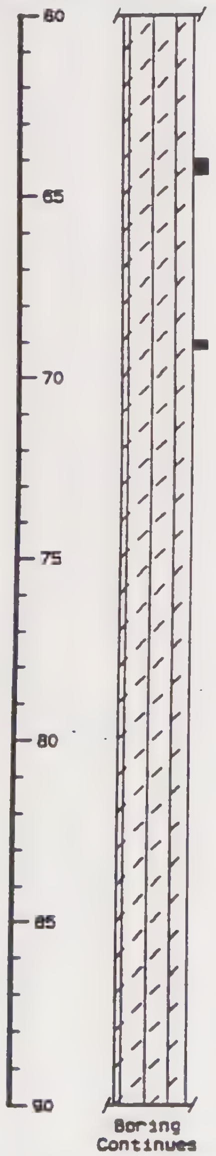
BORING 54

Boring No: 54
Date Drilled: 9-23-92
Elevation: N/A
Logged by: RR

Project No: 5541

Water Level: 40'

After: 40'



ELEV / DEPTH	USCS	SOIL DESCRIPTION	REMARKS	Sample No.	Blows foot	Density Dry-pcf	Moisture Percent
64		Blue grey pebbly SANDSTONE		54-2	50/5"		
69		As above to Gravelly SANDSTONE		54-3	50/3"		

Figure Number

TERRASEARCH, Inc.

LOG OF TEST BORING

BORING 54

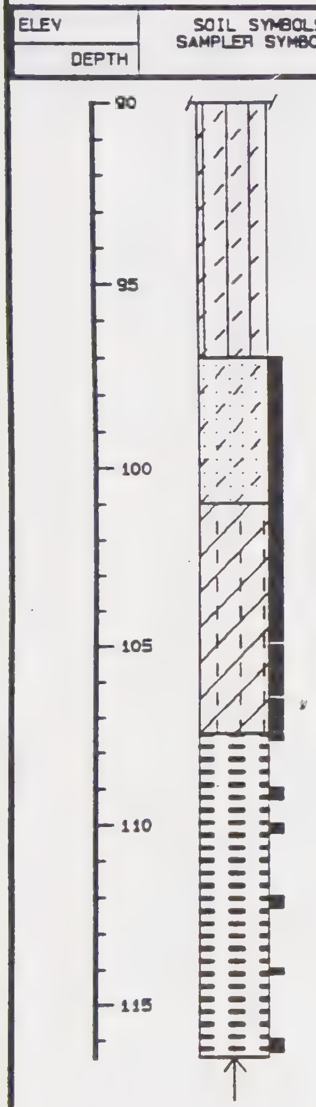
Boring No: 54 | Project No: 5541

Date Drilled: 9-23-92

Elevation: N/A

Logged by: RR

Water Level: 40' | After: 40'



USCS	SOIL DESCRIPTION	REMARKS	Sample No.	Blows foot	Density Dry-pcf	Moisture Percent
	Softer at 94'.					
	Blue grey Clayey SAND (or soft Sandstone), scattered caliche blebs & nodules H2S odor		54-4	42		
			54-5	50/8"		
			54-4	41		
			54-7	50		
			54-8	46		
	Grades through Clayey SILT to Silty CLAY, dark blue green or greenish blue grey		54-9	44		
	Dark blue green Silty CLAY with pods or lenses of fine Sand		54-10	54		
	As above with polished partings		54-11	57		
			54-12	50		
	Light blue grey pebbly SANDSTONE in shoe, very hard, calcite-cemented	Drilled 108.2 - 109.0'	54-13	50/2"		
	As above, but more Gravelly	Drilled 109.4-110.0'	54-14	50/4"		
		2" sampler	54-15	50/3"		
			54-16	50/4"		
			54-17	50/2"		
			54-18	50/4"		
	Boring terminated at 116.5' No groundwater encountered.					

Figure Number

TERRASEARCH, Inc.

LOG OF TEST BORING

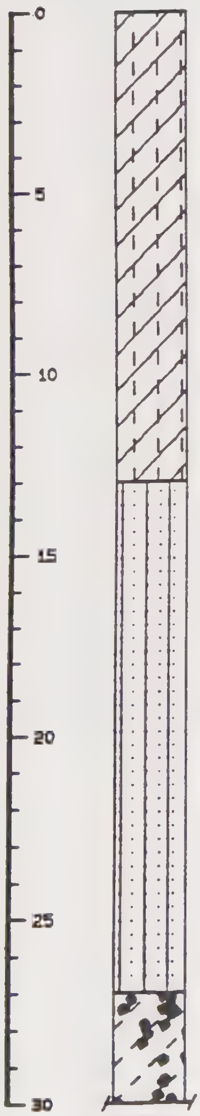
BORING 55

Boring No: 55
Date Drilled: 9-29-92
Elevation: N/A
Logged by: RR

Project No: 5541

Water Level: N/A

After: N/A



Boring Continues

ELEV / DEPTH	SOIL SYMBOLS / SAMPLER SYMBOLS	USCS	SOIL DESCRIPTION	REMARKS	Sample No.	Blows foot	Density Dry-pcf	Moisture Percent
0			Medium to light brown pebbly Silty CLAY and Clayey SILT					
			Light tan Gravelly SILT and SAND					
			Brown Clayey GRAVEL					

Figure Number

LOG OF TEST BORING

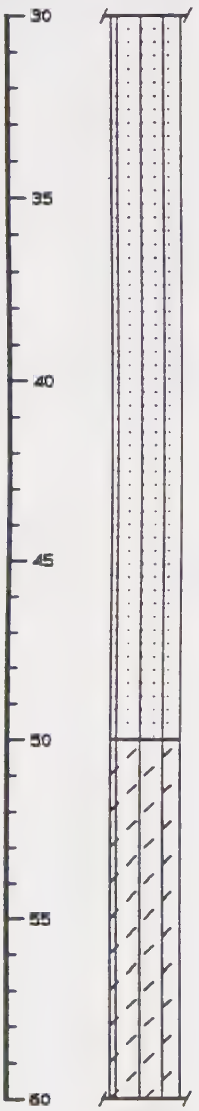
BORING 55

Boring No: 55
Date Drilled: 9-29-92
Elevation: N/A
Logged by: RR

Project No: 5541

Water Level: N/A

After: N/A



Boring Continues

ELEV / DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS	USCS	SOIL DESCRIPTION	REMARKS	Sample No.	Blows foot	Density Dry-pcf	Moisture Percent
30			Brown Clayey SAND and SILT					
45			More moist					
50			Blue grey Clayey SILT					

Figure Number

LOG OF TEST BORING

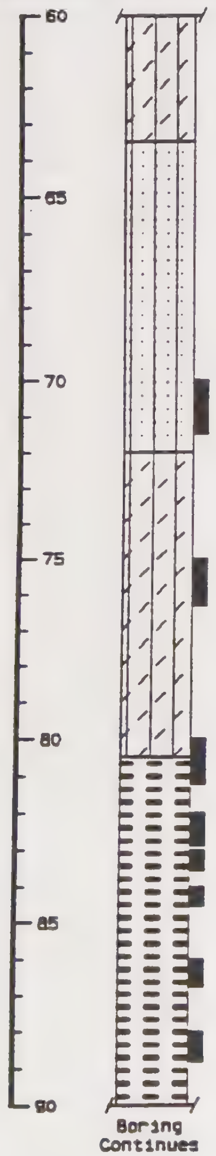
BORING 55

Boring No: 55
Date Drilled: 9-29-92
Elevation: N/A
Logged by: RR

Project No: 5541

Water Level: N/A

After: N/A



ELEV / DEPTH	SOIL SYMBOLS / SAMPLER SYMBOLS	USCS	SOIL DESCRIPTION	REMARKS	Sample No.	Blows foot	Density Dry-pcf	Moisture Percent
			Blue grey Sandy SILT					
					55-1	42		
			Blue grey Clayey SILT and Silty CLAY					
					55-2	42		
					55-3	51		
			Khaki or light olive with red brown spots Clayey SANDSTONE		55-4	50/5"		
					55-5	45		
			Cleaned out and drilled to 82'	Drilled 83.6 to 84.0'	55-6	49/7"		
			Tan to red brown interlaminated very fine to very coarse SAND, near horiz. bedding		55-7	35/6"		
				Drilled 84.5 to 86.0'	55-8	51/9"		
				Drilled 86.75-88.0'	55-9	48/10"		
				Drilled 89 to 90'				

Figure Number

LOG OF TEST BORING

BORING 55

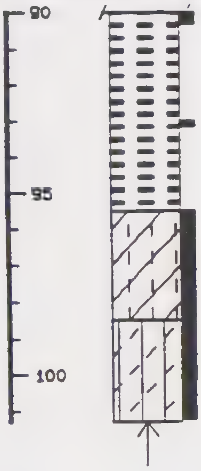
Boring No: 55 | Project No: 5541

Date Drilled: 9-29-92

Elevation: N/A

Logged by: RR

Water Level: N/A | After: N/A



ELEV / DEPTH	SOIL SYMBOLS / SAMPLER SYMBOLS	USCS	SOIL DESCRIPTION	REMARKS	Sample No.	Blows foot	Density Dry-pcf	Moisture Percent
90			As above, but coarser with some small pebbles	Drilled to 93'	55-10	50/4"		
			As above with some Gravel	Drilled to 95.5'	55-11	50/2"		
95			Blue grey Silty CLAY with specks and blocks of caliche		55-12	37		
					55-13	47/9"		
			Blue grey Clayey SILT with scattered pebbles		55-14	47/10"		
100					55-15	55		
			As above, but no pebbles		55-16	49/10"		
			Boring terminated at 101.3' No groundwater encountered.					

Figure Number ..

TERRASEARCH, Inc.

LOG OF TEST BORING

BORING 56

Boring No: 56
Date Drilled: 11/5/96
Elevation: N/A
Logged by: RR

Project No: 5541

Water Level: NONE
After:

DEPTH	USCS	SOIL DESCRIPTION	REMARKS	Sample No.	Blows foot	Density Dry-pcf	Moisture Percent
0	ML	Medium brown sandy clayey SILT.					
9	ML	Light brown sandy clayey SILT.					
15		grades pebbly (sub ang. clasts olive drab Cret. SLTST to 1")					

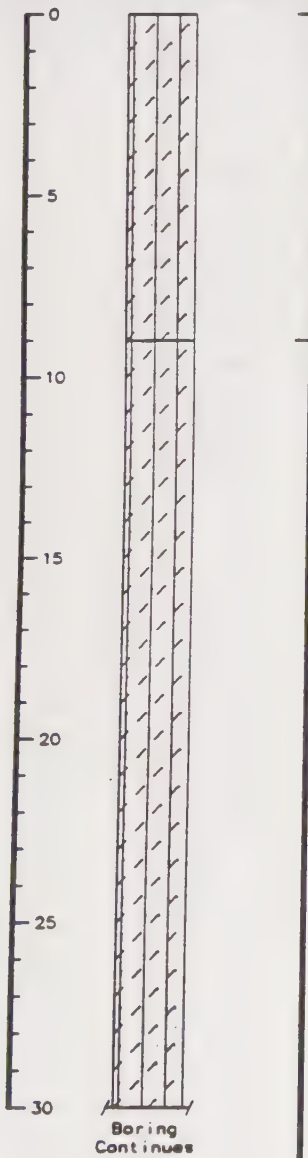


Figure Number ____

TERRASEARCH, Inc.

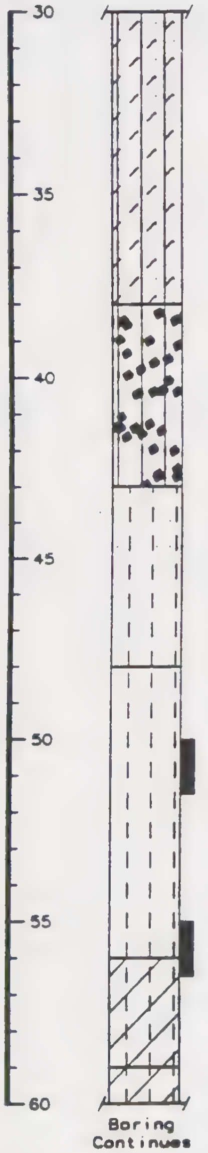
LOG OF TEST BORING

BORING 56

Boring No: 56
Date Drilled: 11/5/96
Elevation: N/A
Logged by: RR

Project No: 5541

Water Level: NONE   After:



ELEV / DEPTH	USCS	SOIL DESCRIPTION	REMARKS	Sample No.	Blows foot	Density Dry-pcf	Moisture Percent
30–35		grades darker					
38	GM	Harder at 38 feet Pebbly SILT and silty GRAVEL well rounded pebbles to 1" diameter.					
43		more clayey and moist					
48	SM	Light brown very fine grain silty SAND or sandy SILT, dense, dry.					
50				56-1	50/4"		
55				50-2a	59		
56	CL	Light brown silty CLAY.		55-2b			
59	CL	Olive brown silty CLAY.					

Figure Number ____

TERRASEARCH, Inc.

LOG OF TEST BORING

BORING 56

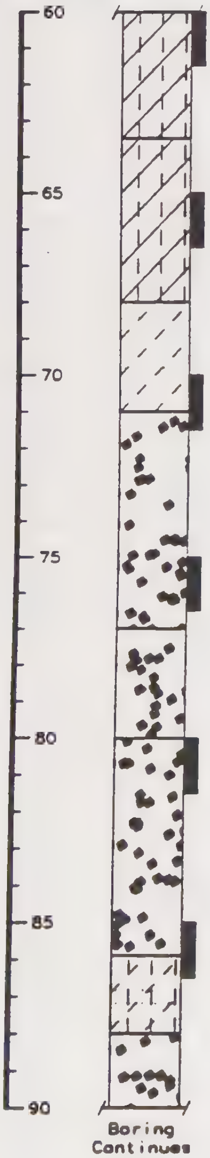
Boring No: 56 | Project No: 5541

Date Drilled: 11/5/96

Elevation: N/A

Logged by: RR

Water Level: NONE | After:



USCS	SOIL DESCRIPTION	REMARKS	Sample No.	Blows foot	Density Dry-pcf	Moisture Percent
			56-3	50/4"		
CL	Varicolored tan and red brown silty CLAY w/pods blue grey clayey silt. mottling colors		56-4	50/6"		
SC	Medium brown clayey SAND w/ pebbles, mottled white/red/ brown, some breeciated texture in clay zones, well rounded pebbles to 1".		56-5	60/3.5		
	Reddish brown SANDSTONE, fragments of boulder or cobble, highly weathered, weak, fractured, fine grain orange mottlingin fracture. (Gravel)	Harder @ 71'	56-6	75/4"		
GW	Sub to well rounded chert, quartz gravel.					
GP	Reddish brown med to coarse sandy 1-2" GRAVEL, dry, very dense, weakly cemented.		56-7	75/4"		
			56-8a 85-8b	50/4"		
ML	Med brown clayey silty SAND very poorly sorted, moist.		56-9	50/3"		
GP	Reddish brown med to coarse sandy 1-2" GRAVEL, deeply weathered w/ gypsum.					

Figure Number ____

TERRASEARCH, Inc.

LOG OF TEST BORING

BORING 56

Boring No: 56
Date Drilled: 11/5/96
Elevation: N/A
Logged by: RR

Project No: 5541

Water Level: NONE

After:

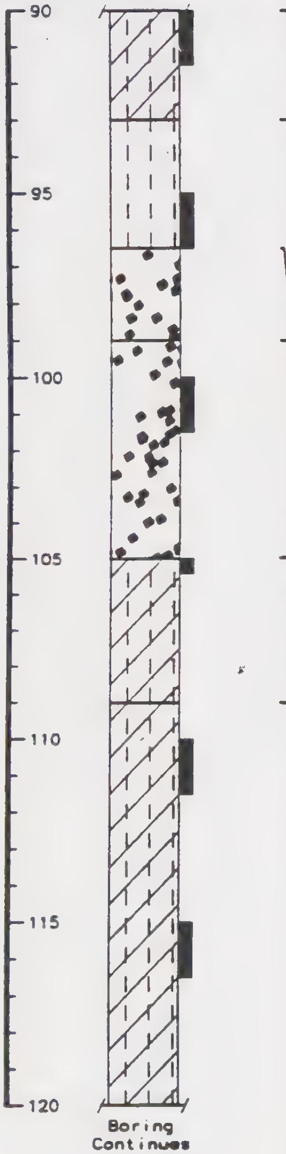
ELEV / DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS	USCS	SOIL DESCRIPTION	REMARKS	Sample No.	Blows foot	Density Dry-pcf	Moisture Percent
		CL	Mottled brown and blue grey silty CLAY, soft, slight moist, more waxy.		56-10	67		
		SM	Mottled light tan pebbly silty SAND, isolated small well rounded pebbles, dry, dense, chaotic texture w/ irregular blabs of whitish sand w/ carbonate? matrix.		56-11	75/4"		
		GW	GRAVEL, w/ sub to well rounded clasts to 1".					
		GW	Tan to grey brown fine to very fine grained SANDSTONE dry, (fragmented cobbles).		56-12	75/5"	incomp.	sample
		SC/ SM	Mottled tan/red brown/lt blue grey, clayey silt/ silty clay/ pebbly sand w/ well rounded clasts to 3/4".		56-13	80/5"	incompl	sample
		CL	Blue green silty CLAY, slight moist, massive w/ minor interbeds clayey silt		56-14	62		
					56-15	54		

Figure Number ____

LOG OF TEST BORING

BORING 56

Boring No: 56
Date Drilled: 11/5/96
Elevation: N/A
Logged by: RR

Project No: 5541

Water Level: NONE

After:

ELEV / DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS	USCS	SOIL DESCRIPTION	REMARKS	Sample No.	Blows foot	Density Dry-pcf	Moisture Percent
120			as above except mostly clayey SILT, w/ minor silty clay and some fn sand		56-16	70		
			End of Boring at 121.5 feet No groundwater encountered					

Figure Number ____

TERRASEARCH, Inc.

LOG OF TEST BORING

BORING 57

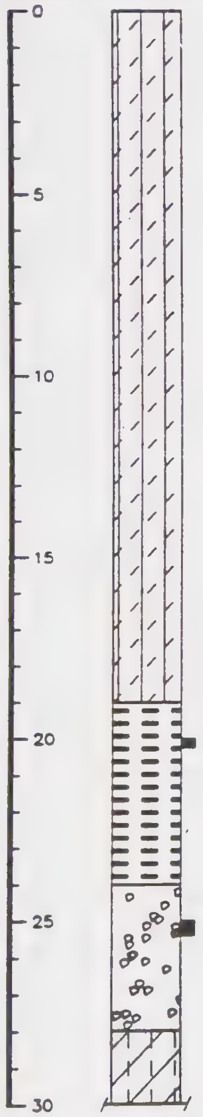
Boring No: 57
Date Drilled: 11/6/96
Elevation: N/A
Logged by: RR

Project No: 5541

Water Level: NONE

After:

ELEV / DEPTH | SOIL SYMBOLS SAMPLER SYMBOLS



Boring Continues

USCS	SOIL DESCRIPTION	REMARKS	Sample No.	Blows foot	Density Dry-pcf	Moisture Percent
ML	Light brown pebbly clayey SILT, w/ well rounded cobbles to 4" diameter.					
	Medium brown pebbly clayey SILT slightly moist.					
	more gravelly at 10 feet					
	light olive color.					
	Mottled rusty tan SANDSTONE fragments in CGL or on boulder.		57-1	50/3"	disturb	sample
SW	Mottled tan/white/red-brown pebbly to gravelly SAND w/ scattered cobbles & boulder		57-2	50/5"		
CL	Mottled olive/red-brown silty CLAY w/ interbedded sand and gravel, slightly moist to moist.					

Figure Number ____

TERRASEARCH, Inc.

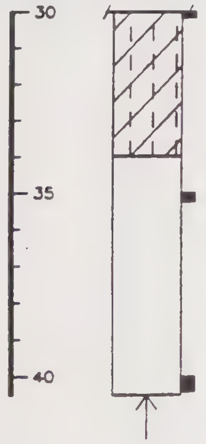
LOG OF TEST BORING

BORING 57

Boring No: 57
Date Drilled: 11/6/96
Elevation: N/A
Logged by: RR

Project No: 5541

Water Level: NONE   After:



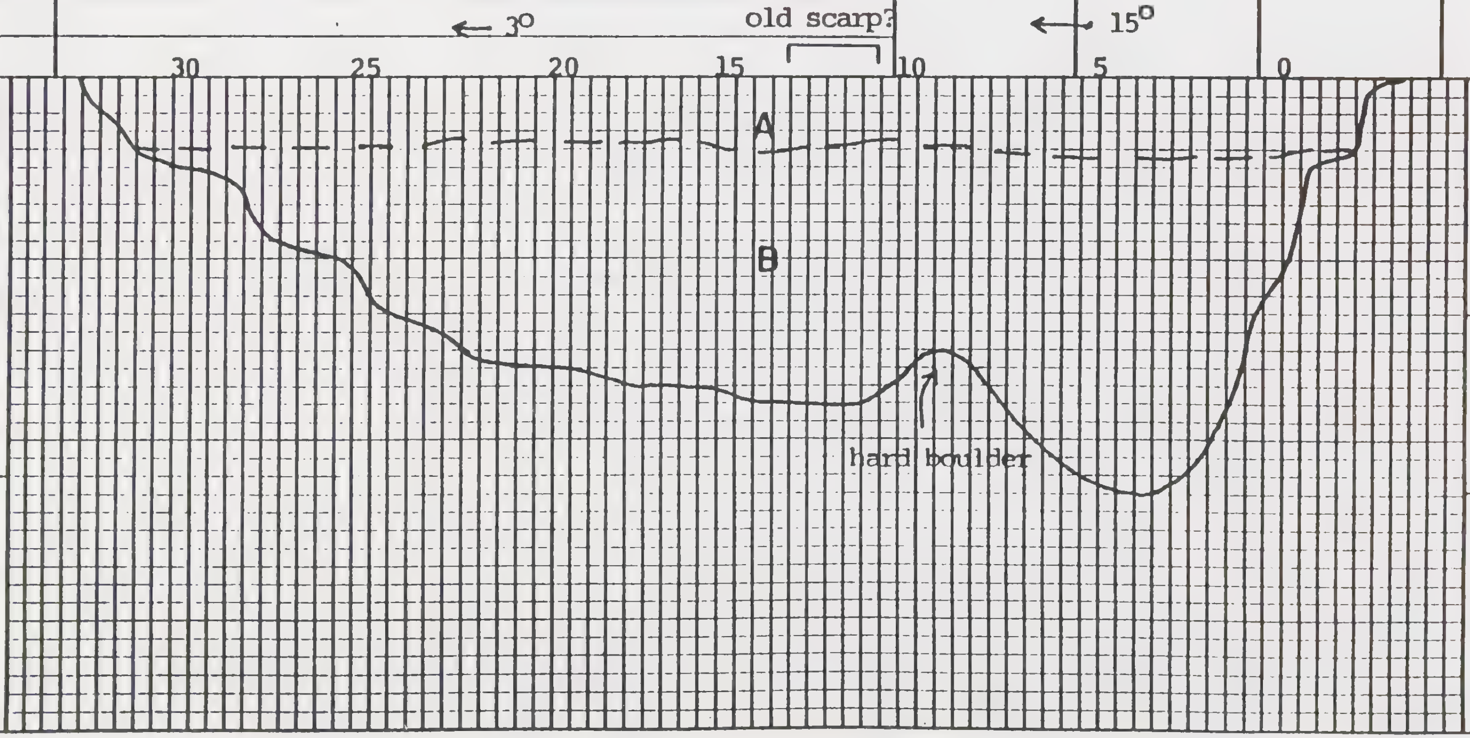
ELEV / DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS	USCS	SOIL DESCRIPTION	REMARKS	Sample No.	Blows foot	Density Dry-pcf	Moisture Percent
30					57-3	50/2"		
		SW	Mottled pebbly to gravelly SAND, chaotic coloration.					
35					57-4	50/3"		
			Mottled red-brown pebbly to gravelly SAND and sandy gravel, dense, highly weathered.					
40					57-5	50/5"		
			End of Boring at 40.5 feet No Groundwater Encountered					

Figure Number _____

TERRASEARCH, Inc.

ELEV. LOGGED BY RR DATE LOGGED 12/13/87

DEPTH	MATERIALS DESCRIPTION TYPE, COLOR, MOISTURE, CONSOLIDATION, ETC.	ATTITUDES			COMMENTS
		BEDDING	JOINTS	FAULT or SHEAR	
0 - 2 (A)	Dark brown pebbly Clayey SILT (topsoil); moist, friable, locally sticky	none	none	none	Located on lateral scarp of old slide
2 - 11.5 (B)	Medium brown Gravelly Sandy Clayey SILT (QTl?): very hard and dense; slightly moist, isolated rounded cobbles and boulders to 18 inches diameter; local Clayey zones; grades red-brown with depth; hard digging	none	none	none	



TERRASEARCH INC.

TEST PIT LOG No. 1

Figure No.

SCALE

HORIZ. 1"—5'

VERT. 1"—5'

PIT ORIENTATION

N45W →

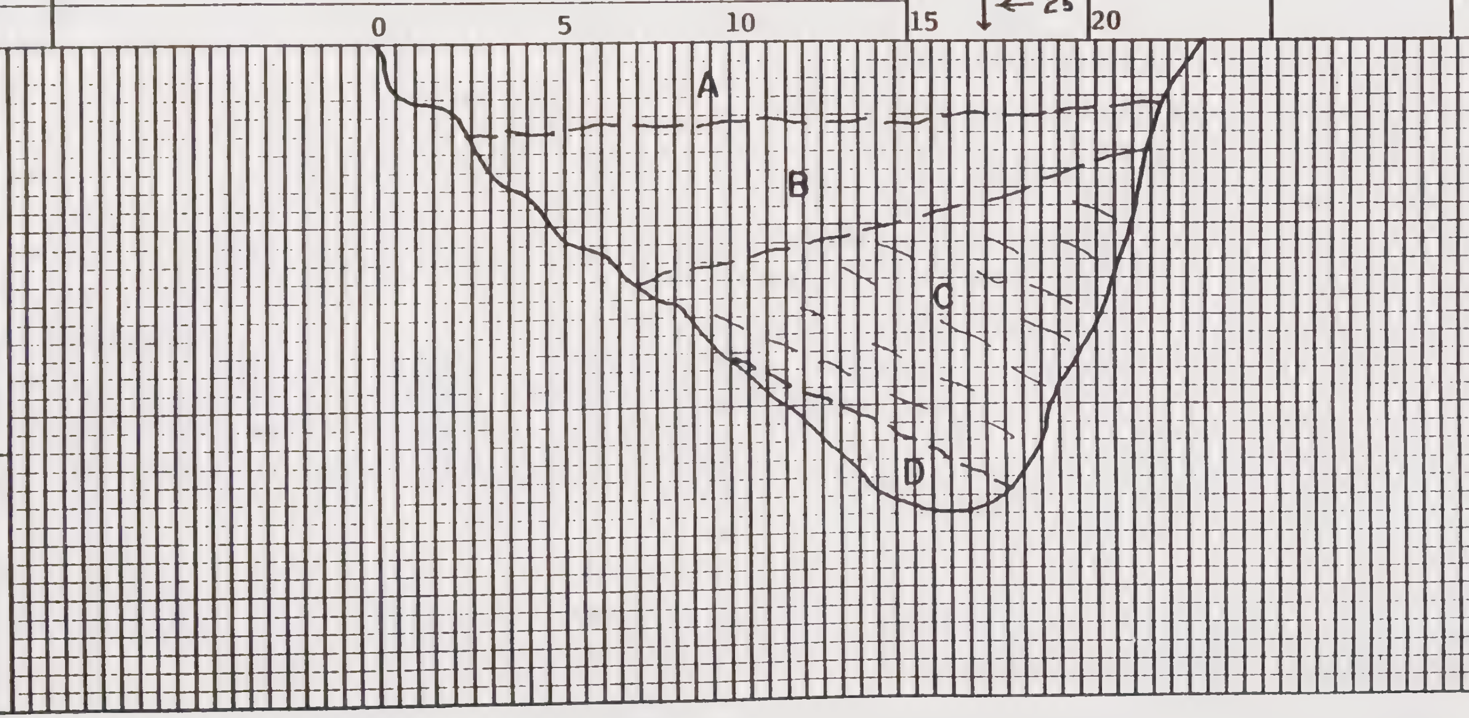
NATURAL SLOPE

ANGLE 3° to 15° ←

T.D. 11.5'

ELEV. LOGGED BY RR DATE LOGGED 12/15/87

DEPTH	MATERIALS DESCRIPTION TYPE, COLOR, MOISTURE, CONSOLIDATION, ETC.	ATTITUDES BEDDING	JOINTS	FAULT or SHEAR	COMMENTS
0 - 2.5	Dark brown pebbly Clayey SILT (topsoil)	none	none	none	
(A)					
2.5-6.5	Dark brown Silty Clayey GRAVEL and Gravelly CLAY	none	none	none	
(B)	(colluvium and weathered QT1)				
6.5-11.0	Tan to medium brown interbedded SAND, GRAVEL and SILT	N70W, 8°N	none	none	
(C)	with minor CLAY; fairly well-bedded				
11.5-13.0	Light grey brown, Gravelly Silty CLAYSTONE; (rounded				
(D)	pebbles in soft CLAYSTONE matrix) (QT1)				
		Scarp-like feature			
	← 15°	← 25°			



SCALE	
HORIZ.	1"—5'
VERT.	1"—5'

PIT ORIENTATION

due W →

NATURAL SLOPE

ANGLE 15° to 25° ←

T.D. 13'

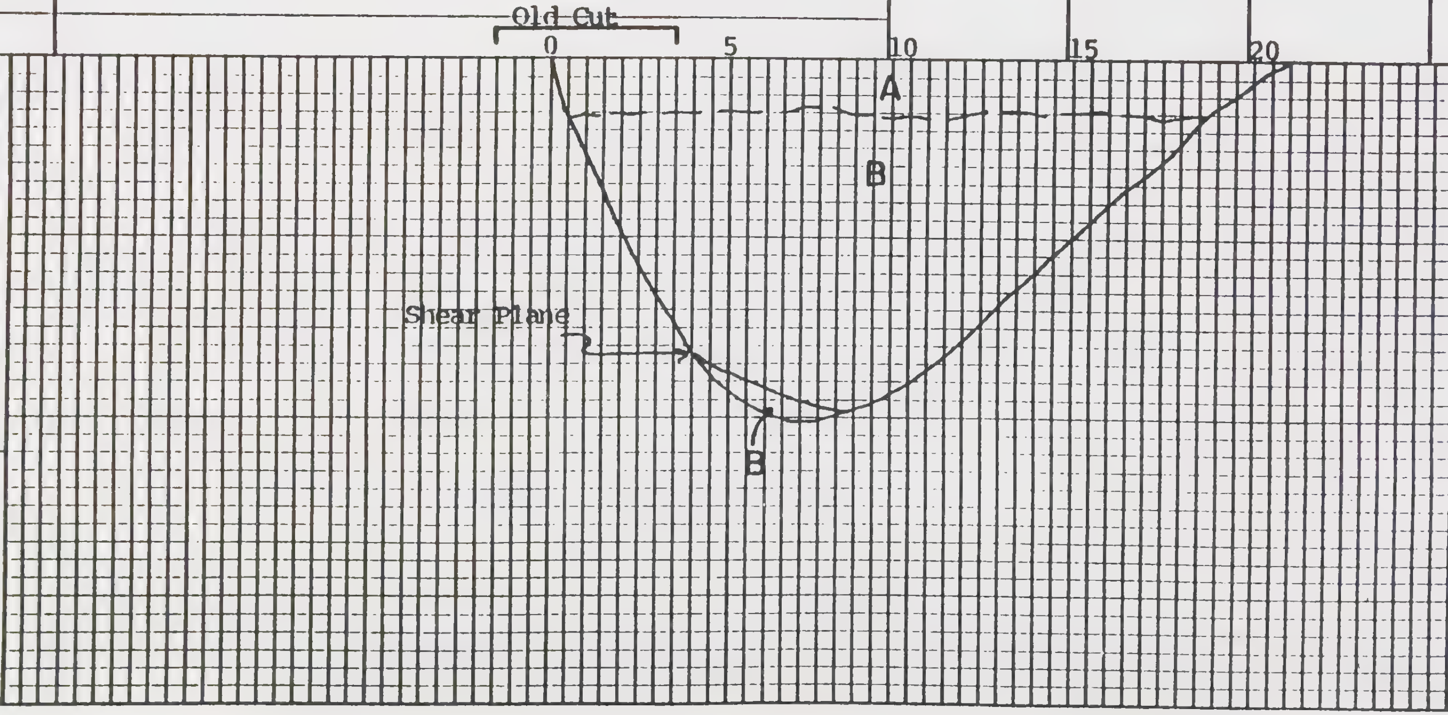
TEST PIT LOG No. 2

Figure No.

TERRASEARCH INC.

ELEV. LOGGED BY DATE LOGGED 12/17/87

DEPTH	MATERIALS DESCRIPTION TYPE, COLOR, MOISTURE, CONSOLIDATION, ETC.	ATTITUDES BEDDING	JOINTS	FAULT or SHEAR	COMMENTS
0 - 1.5 (A)	Dark brown pebbly Clayey SILT; firm, very moist	none	none	none	Located at possible man-made cutface 5 feet high
1.5-10.0 (B)	Tan to grey brown Clayey GRAVEL and Gravelly CLAY, vauge color layering dips north abount 25 degree; very hard and dense; top 2 feet moist, sticky clay-coated, slickensided, semi-planar Clay seam near bottom of pit	?	none	N61E,23N slicks plunge 18°N30E	



SCALE

HORIZ. 1"—5'

VERT. 1"—5'

PIT ORIENTATION

N45W

NATURAL SLOPE

ANGLE 10°

T.D. 10'

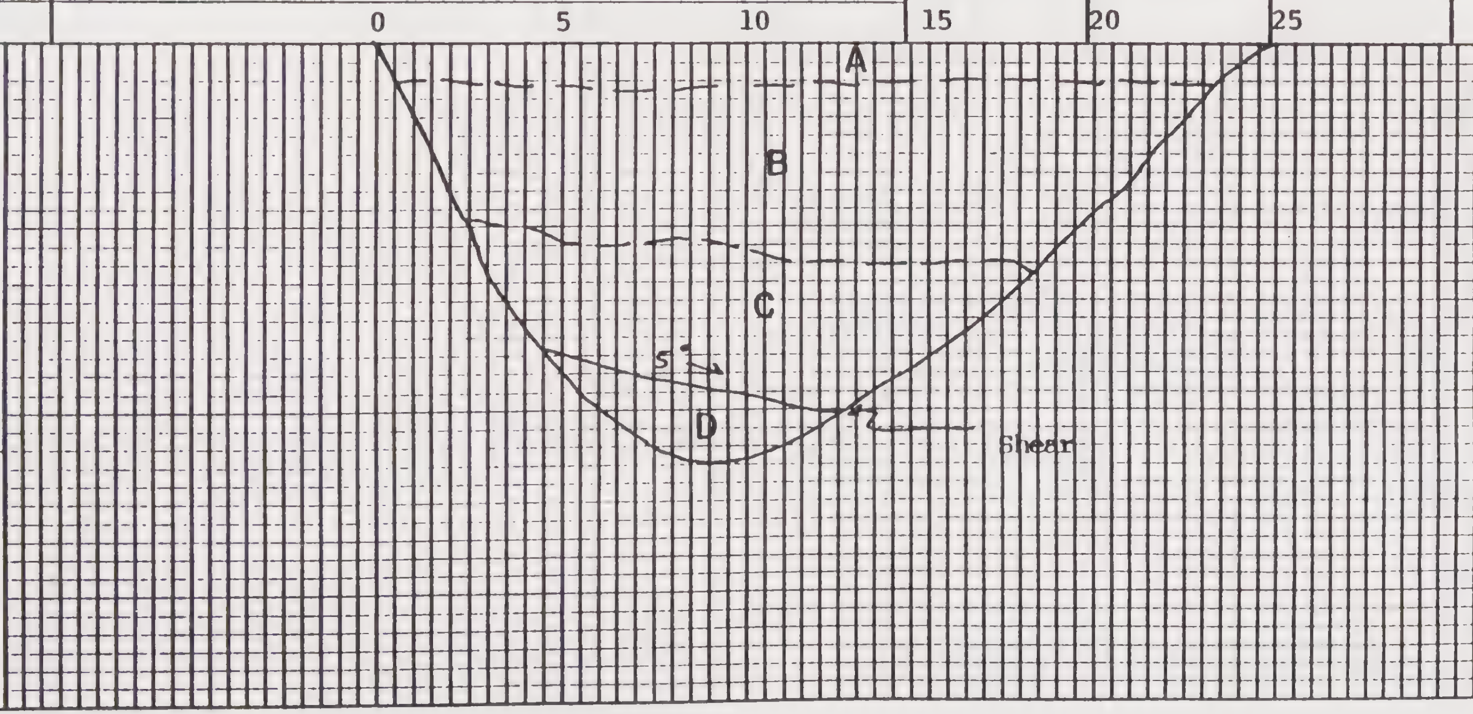
TEST PIT LOG No. 3

Figure No.

TERRASEARCH INC.

ELEV. LOGGED BY RR DATE LOGGED 12/17/87

DEPTH	MATERIALS DESCRIPTION TYPE, COLOR, MOISTURE, CONSOLIDATION, ETC.	ATTITUDES BEDDING	 JOINTS	 FAULT or SHEAR	COMMENTS
0 - 1.0 (A)	Medium/dark brown pebbly Silty CLAY or Clayey SILT; soft, porous, very moist, sticky	none	none	none	
1.0-5.0	Mottled medium brown Silty Gravelly CLAY; firm, dense locally loose, top 2 feet moist, sticky; scattered boulders to 1.5 feet diameter	none	none	none	
5.0-9.0 (C)	Medium/light brown Silty Clayey Gravelly SAND; firm, dense, locally loose, scattered boulders to 2.5 feet diameter; Clay-coated, planar, slickensided shear plane at base	none	none	N58E, 12N: [illegible] slicks plunge 6^{O}N32E	
9.0-11.0 (C)	as in (B) but harder, more dense	none	none		



SCALE	HORIZ. 1"—5' VERT. 1"—5'
PIT ORIENTATION	N30E
NATURAL SLOPE	ANGLE 12^{O}
T.D.	11.5'

TEST PIT LOG No.4

Figure No.

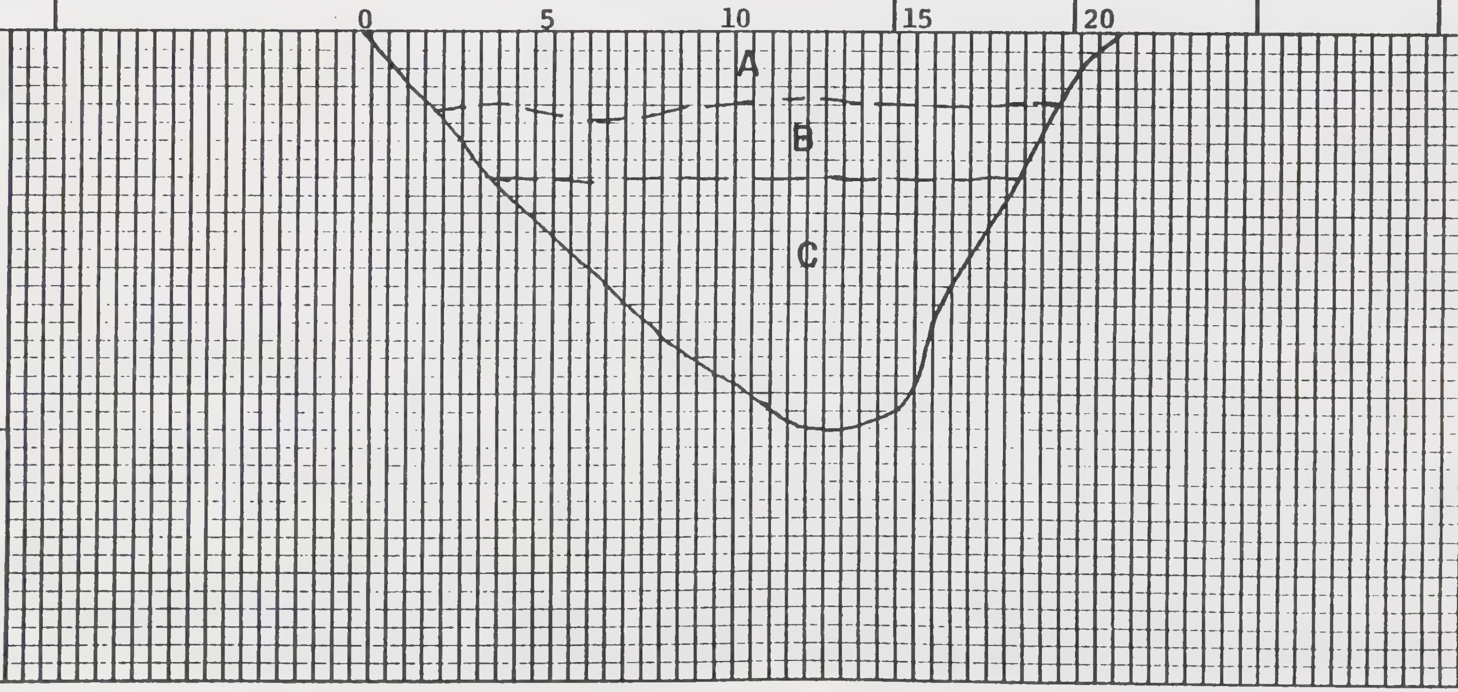
TERRASEARCH INC.

DEPTH	MATERIALS DESCRIPTION TYPE, COLOR, MOISTURE, CONSOLIDATION, ETC.	ATTITUDES BEDDING	 JOINTS	 FAULT or SHEAR	COMMENTS
0 - 2.0 (A)	Medium/dark brown pebbly Clayey SILT (topsoil) very moist to wet, loose, porous	none	none	none	
2.0-4.0 (B)	Mottled medium brown pebbly Clayey SILT (colluvium); firm, moist	none	none	none	
4.0-11.0 (C)	Mottled light brown Sandy Gravelly Clayey SILT (old slide debris); very hard and dense; scattered subangular cobbles and boulders	none	none	none	

TERRASEARCH INC.

TEST PIT LOG No. 5

Figure No.



SCALE

HORIZ. 1" = 5'

VERT. 1" = 5'

PIT ORIENTATION

N55E →

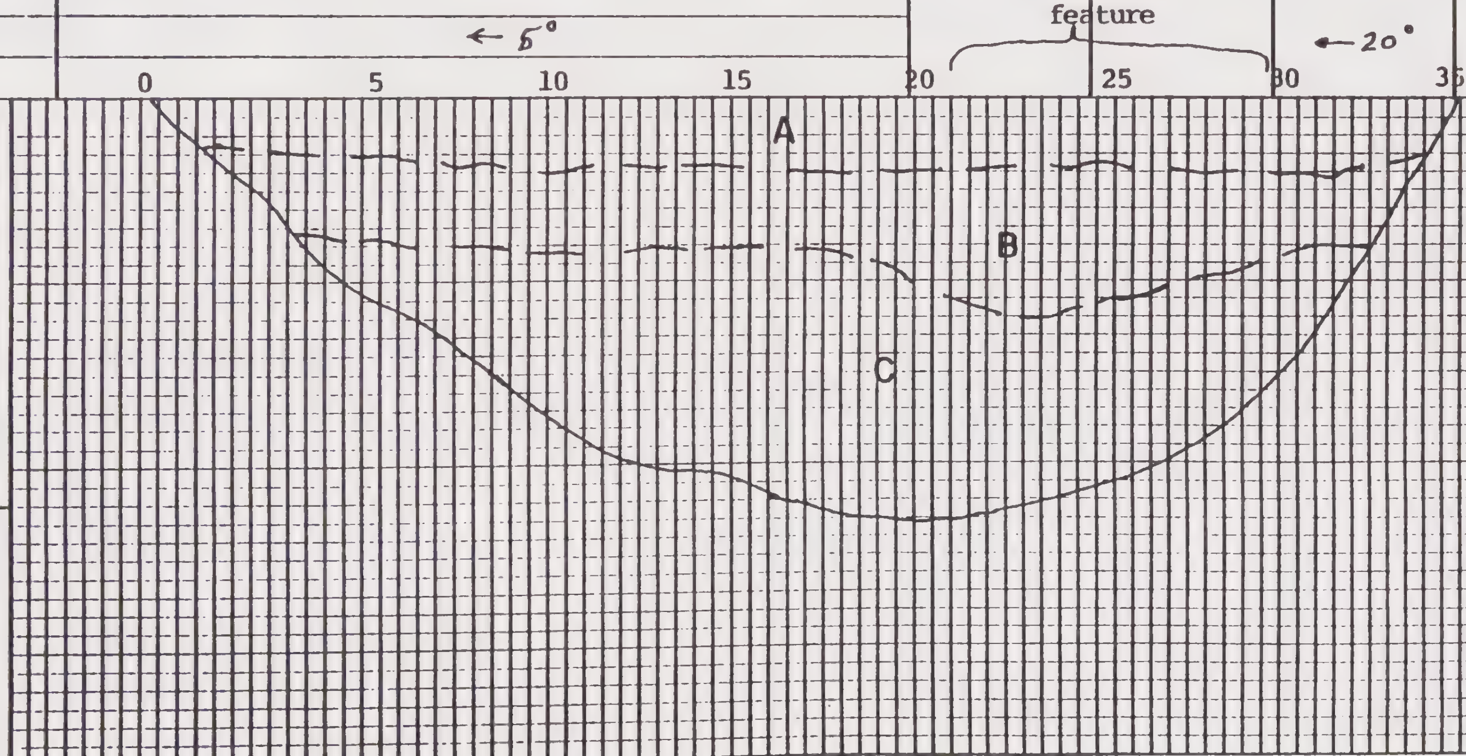
NATURAL SLOPE

ANGLE 3° →

T.D. 11'

ELEV. LOGGED BY RR DATE LOGGED 12/17/87

DEPTH	MATERIALS DESCRIPTION TYPE, COLOR, MOISTURE, CONSOLIDATION, ETC.	ATTITUDES BEDDING	JOINTS	FAULT or SHEAR	COMMENTS
0 - 2.0 (A)	Dark brown pebbly Clayey SILT; moist, loose	none	none	none	
2.0-6.0 (B)	Dark brown pebbly Silty CLAY; moist to lightly moist; colluvium or weathered material	none	none	none	
6.0-10.5 (C)	Medium/light brown Gravelly Clayey SILT; very hard and dense, massive	none	none	none	



TEST PIT LOG No. 6 Figure No.

TERRASEARCH INC.

SCALE

HORIZ. 1" — 5'

VERT. 1" — 5'

PIT ORIENTATION

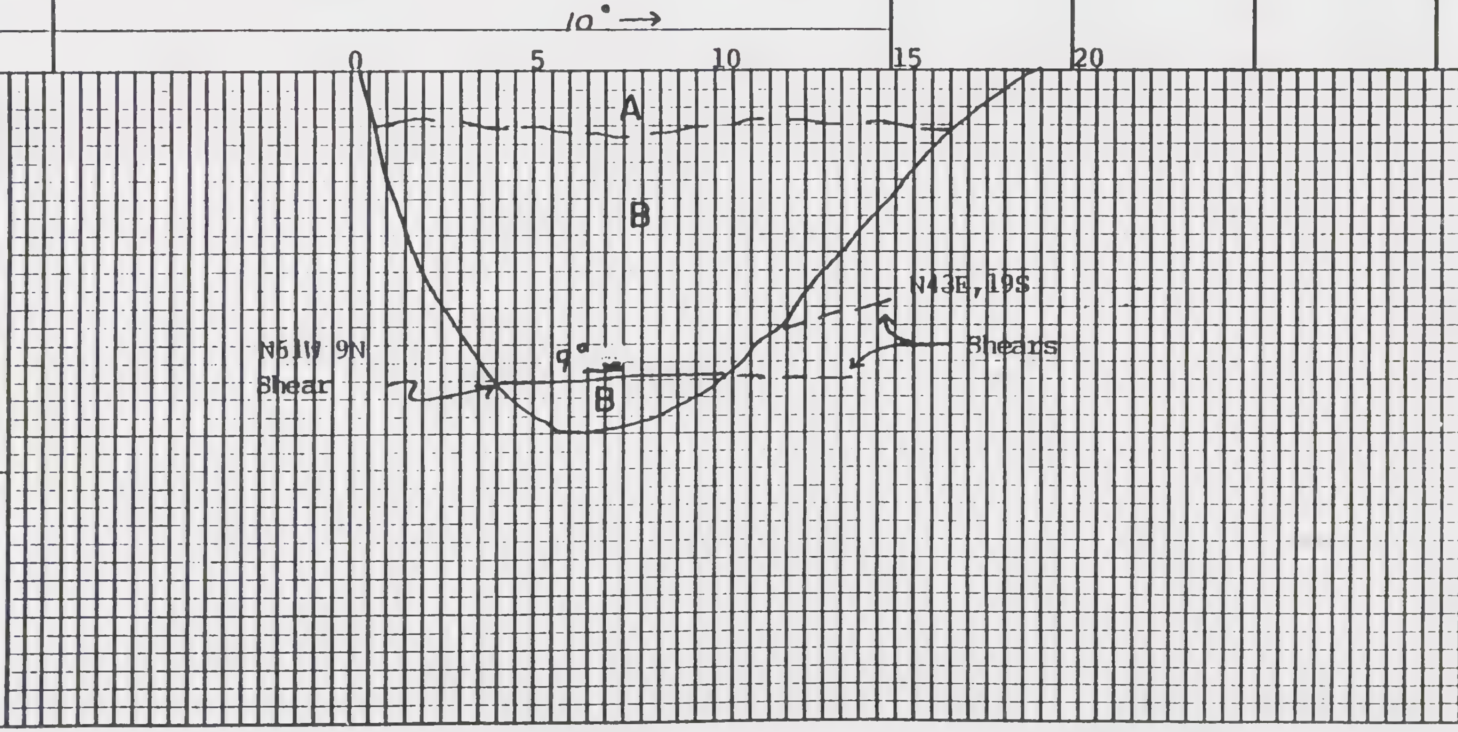
N85W →

NATURAL SLOPE

ANGLE 5° to 20° ←

T.D. 10.5'

DEPTH	MATERIALS DESCRIPTION TYPE, COLOR, MOISTURE, CONSOLIDATION, ETC.	ATTITUDES BEDDING	 JOINTS	 FAULT or SHEAR	COMMENTS
0 - 1.5 (A)	Medium-dark brown pebbly Clayey SILT	none	none	none	
1.5-10.0 (B)	Medium brown Gravelly Clayey SILT, hard, dense, with well rounded cobbles and boulders, lower 2 feet contains planar, slickensided Clay seams (hairline shears)	none	none	N61W, 9N slickensides plunge down dip	



TERRASEARCH INC.

TEST PIT LOG No. 7

Figure No.

SCALE

HORIZ. 1" = 5'

VERT. 1" = 5'

PIT ORIENTATION

N10E →

NATURAL SLOPE

ANGLE 10^0 →

T.D. 9.5'

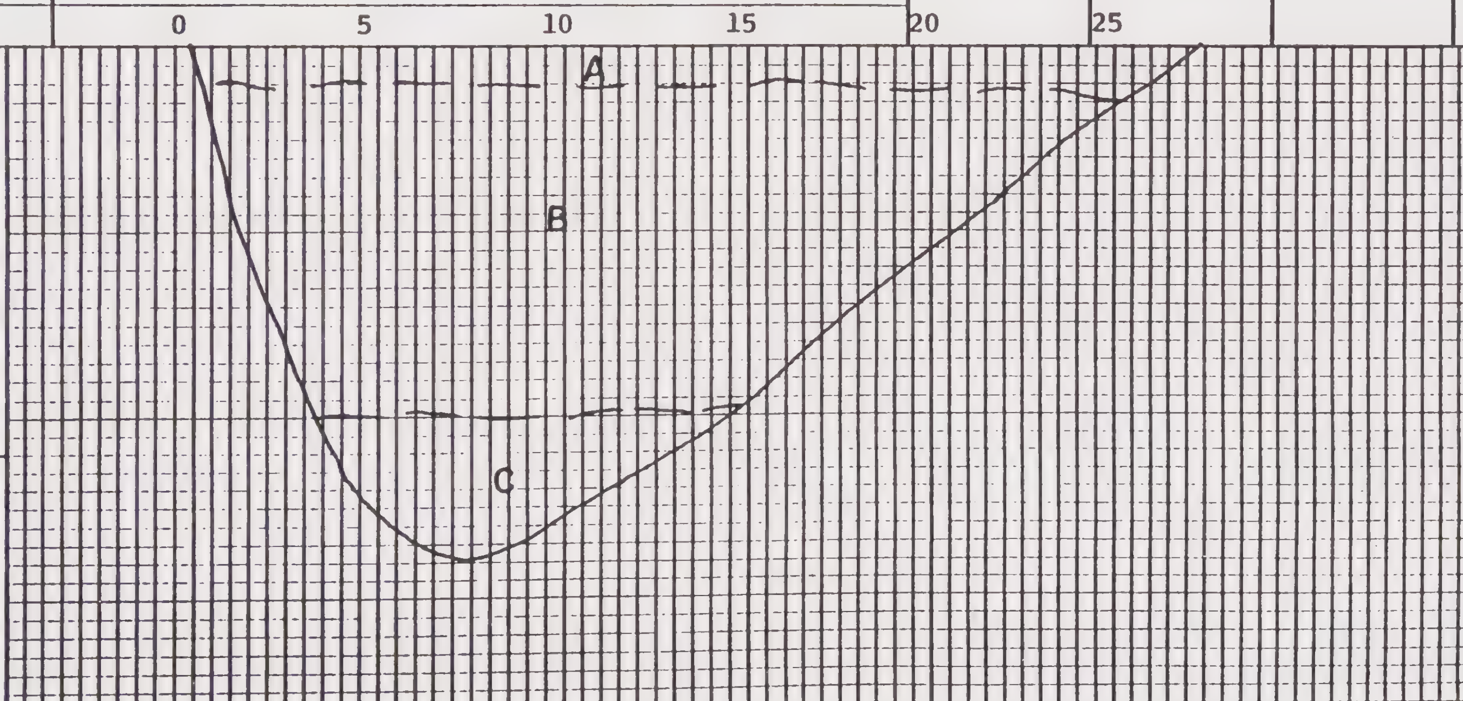
ELEV. LOGGED BY RR DATE LOGGED 12/17/87

DEPTH	MATERIALS DESCRIPTION TYPE, COLOR, MOISTURE, CONSOLIDATION, ETC.	ATTITUDES: BEDDING	ATTITUDES: JOINTS	ATTITUDES: FAULT or SHEAR	COMMENTS
0 - 1.0 (A)	Dark brown pebbly Clayey SILT; moist, loose	none	none	none	
1.0-10.0 (B)	Tan to red brown Clayey Gravelly SILT grading locally to Clayey Silty GRAVEL with Sandy zones; firm to hard; dry to slightly moist	none	none	none	
10.0-14.0 (C)	Dark grey-brown with tan mottling Silty pebbly CLAY; locally Gravelly with scattered cobbles, moist, soft to firm, easy digging	none	none	none	

TERRASEARCH INC.

TEST PIT LOG No. 8

Figure No.



SCALE

HORIZ. 1"=5'

VERT. 1"=5'

PIT ORIENTATION

N65E

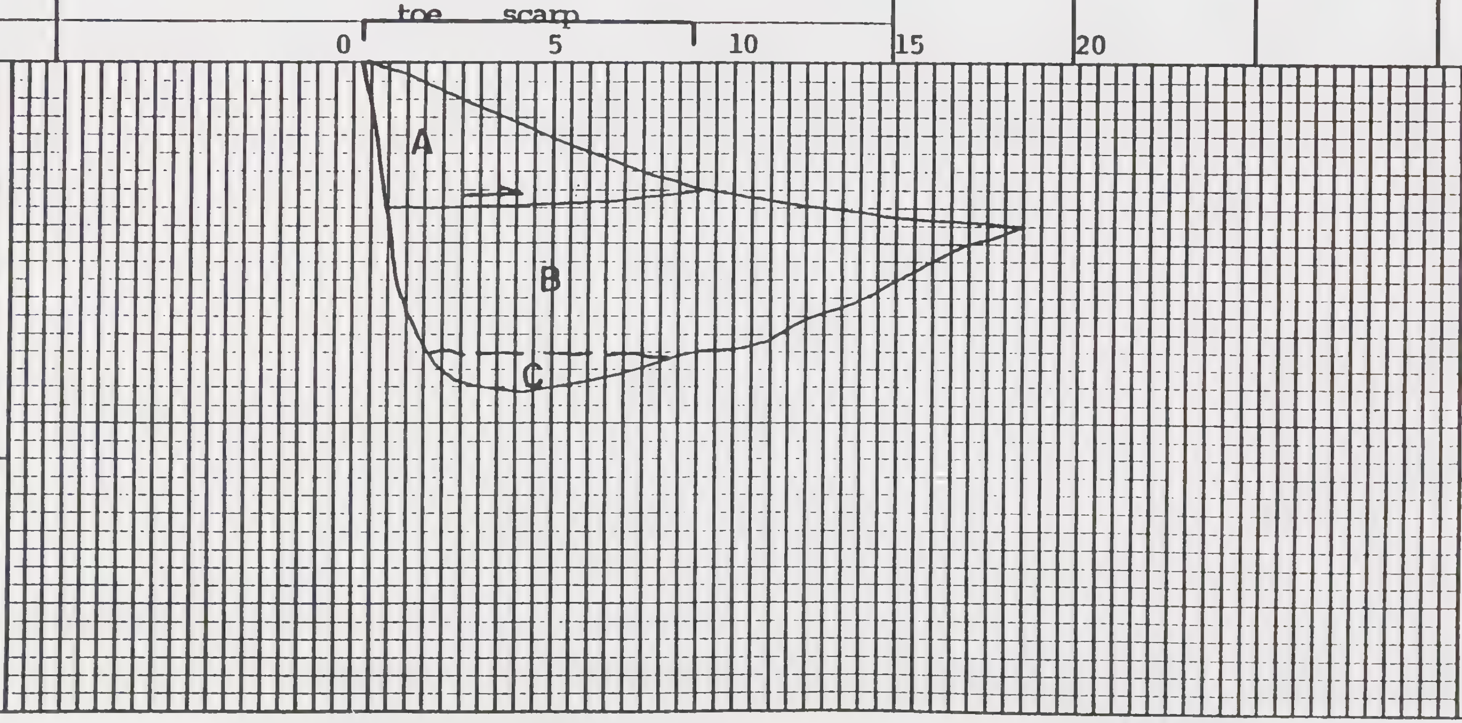
NATURAL SLOPE

ANGLE 13°

T.D. 14'

ELEV. LOGGED BY DATE LOGGED

DEPTH	MATERIALS DESCRIPTION TYPE, COLOR, MOISTURE, CONSOLIDATION, ETC.	ATTITUDES BEDDING	JOINTS	FAULT or SHEAR	COMMENTS
0 - 4.0 (A)	Medium brown pebbly Silty CLAY with scattered well rounded cobbles (dormant slide debris)	none	none	at base: N55W, 15NE	slickensides plunge downdip
4.0-8.0 (B)	Medium/light brown pebbly Clayey SILT; dense, (old slide debris) hard digging	none	none	none	
8.0-9.0 (C)	Medium/light brown Gravelly Clayey SILT or Silty GRAVEL; abundant well rounded cobbles; very hard digging	none	none	none	



TERRASEARCH INC.

TEST PIT LOG No. 9

Figure No.

SCALE

HORIZ. 1" — 5'

VERT. 1" — 5'

PIT ORIENTATION

N30E →

NATURAL SLOPE

ANGLE 26° → to 10° →

T.D. 9'

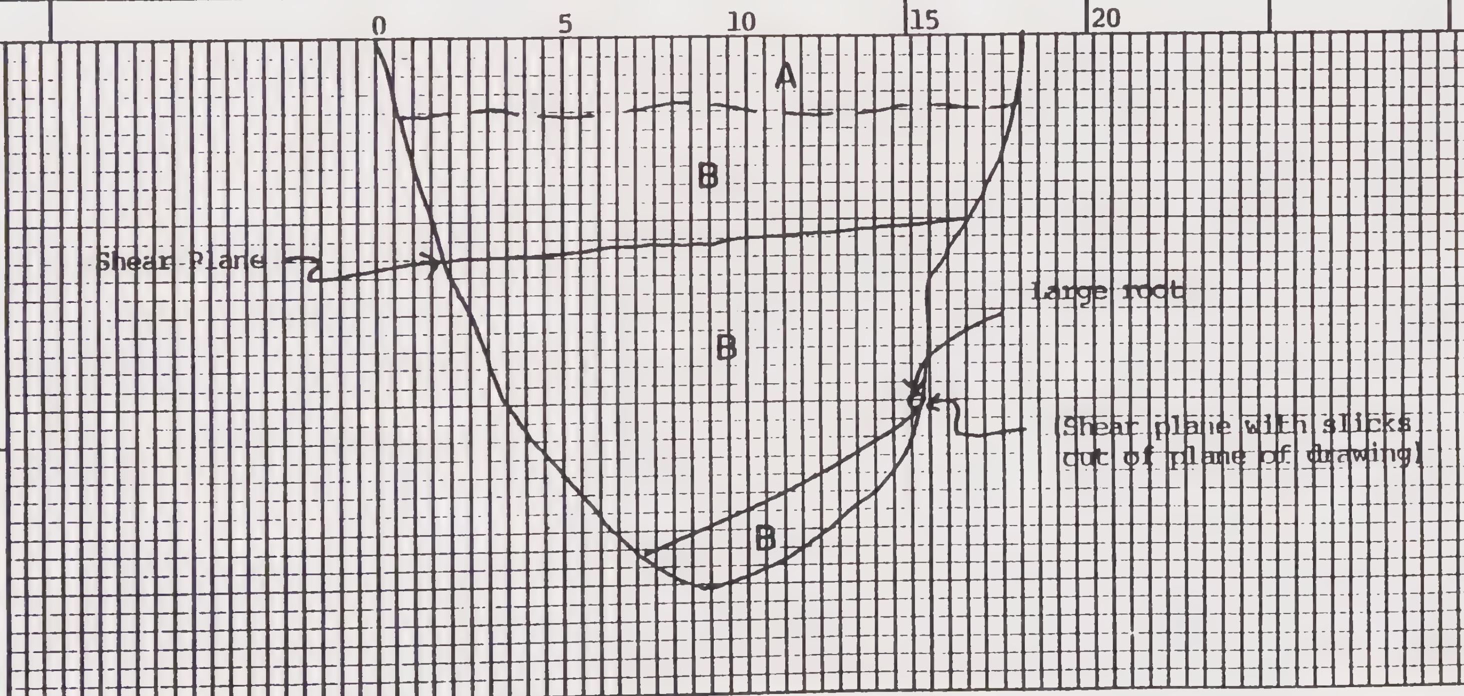
ELEV. | LOGGED BY PR | DATE LOGGED 12/21/87

DEPTH	MATERIALS DESCRIPTION TYPE, COLOR, MOISTURE, CONSOLIDATION, ETC.	ATTITUDES: BEDDING	ATTITUDES: JOINTS	ATTITUDES: FAULT or SHEAR	COMMENTS
0 - 2.0 (A)	Medium/dark brown pebbly Clayey SILT (topsoil) moist, soft, porous	none	none	none	
2.0- 15.0 (B)	Medium brown pebbly Clayey SILT (dormant slide debris); hard, dense, hard digging; scattered well rounded cobbles to 6" diameter isolated boulders to 2 feet diameter; slide planes at 5-6 feet and 10-14 feet	none	none	(at 5-6') N45W, 10°NE slicks down-dip (at 10-14') slicks plunge 10°S60W	

TERRASEARCH INC.

TEST PIT LOG No. 10

Figure No.



SCALE

HORIZ. 1" = 5'

VERT. 1" = 5'

PIT ORIENTATION

N60W

NATURAL SLOPE

ANGLE 2°

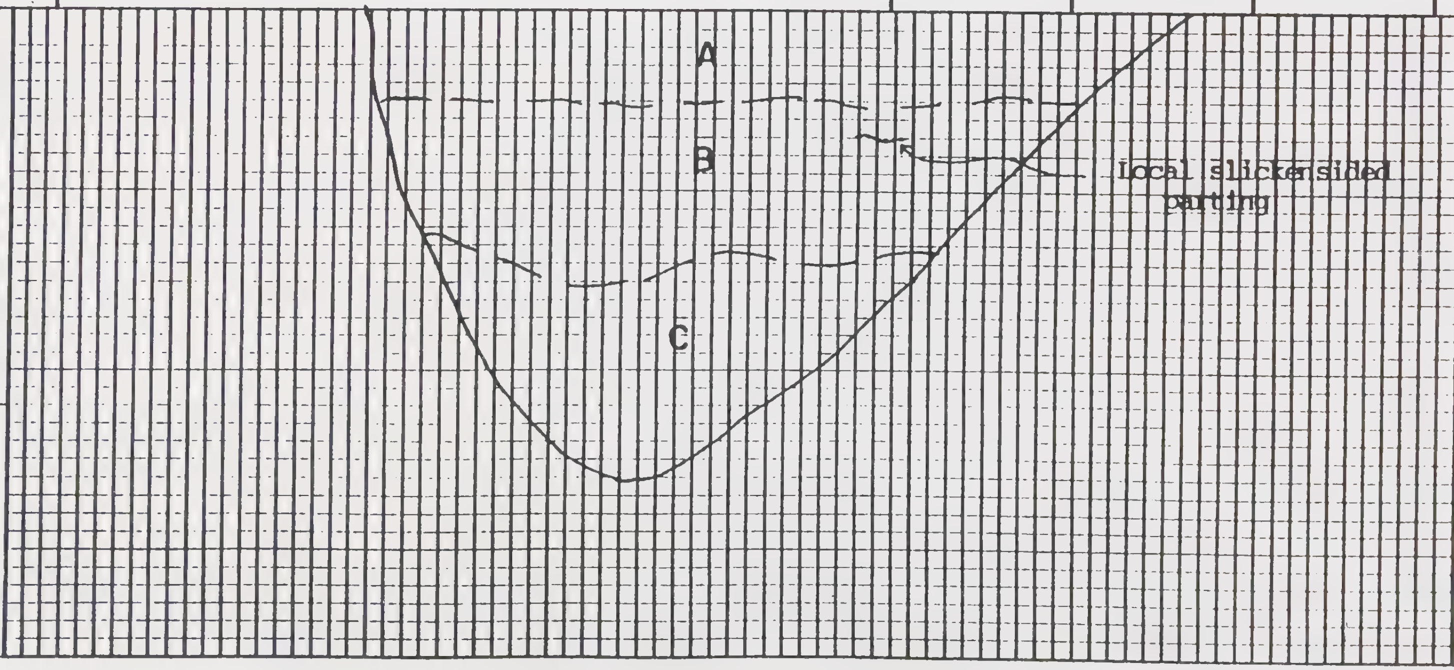
T.D. 15'

DEPTH	MATERIALS DESCRIPTION TYPE, COLOR, MOISTURE, CONSOLIDATION, ETC.	ATTITUDES BEDDING	 JOINTS	 FAULT or SHEAR	COMMENTS
0 - 2.5 (A)	Dark brown Clayey SILT (topsoil)	none	none	none	
2.5-7.0 (B)	Medium brown pebbly Clayey SILT; hard, dense, hard digging; scattered well-rounded cobbles to 5 inch diameter	none	none	none	
7.0-13.0 (C)	Red brown Silty Sandy GRAVEL; dense but locally loose	none	none	none	

TERRASEARCH INC.

TEST PIT LOG No. 11

Figure No.



SCALE

HORIZ. 1" = 5'

VERT. 1" = 5'

PIT ORIENTATION

N12E

NATURAL SLOPE

ANGLE 10^{o}

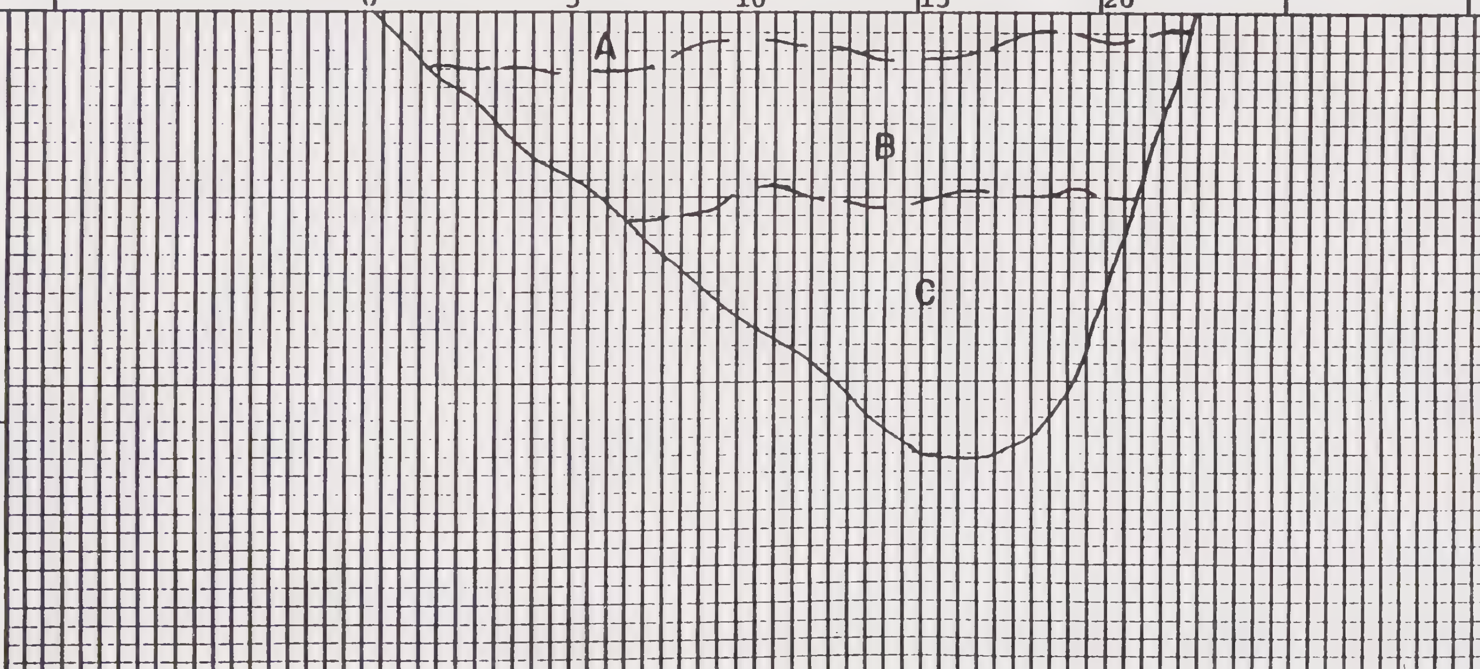
T.D. 13'

ELEV.

LOGGED BY RR

DATE LOGGED 12/21/87

DEPTH	MATERIALS DESCRIPTION TYPE, COLOR, MOISTURE, CONSOLIDATION, ETC.	ATTITUDES BEDDING	ATTITUDES JOINTS	ATTITUDES FAULT or SHEAR	COMMENTS
0 - 1.0 (A)	Dark brown pebbly Silty CLAY or Clayey SILT (topsoil) soft, moist, porous	none	none	none	Located near boring 2
1.0-5.0 (B)	Medium brown pebbly Sandy Clayey SILT, firm, stiff, firm digging (slide debris)	none	none	none	
5.0-12.0 (C)	Medium-dark grey-brown Gravelly Silty CLAY (old slide debris) angular fragments of dark grey SHALE and MUDSTONE: firm digging	none	none	none	



TERRASEARCH INC.

TEST PIT LOG No. 12

Figure No.

SCALE

HORIZ. 1"=5'

VERT. 1"=5'

PIT ORIENTATION

N62W →

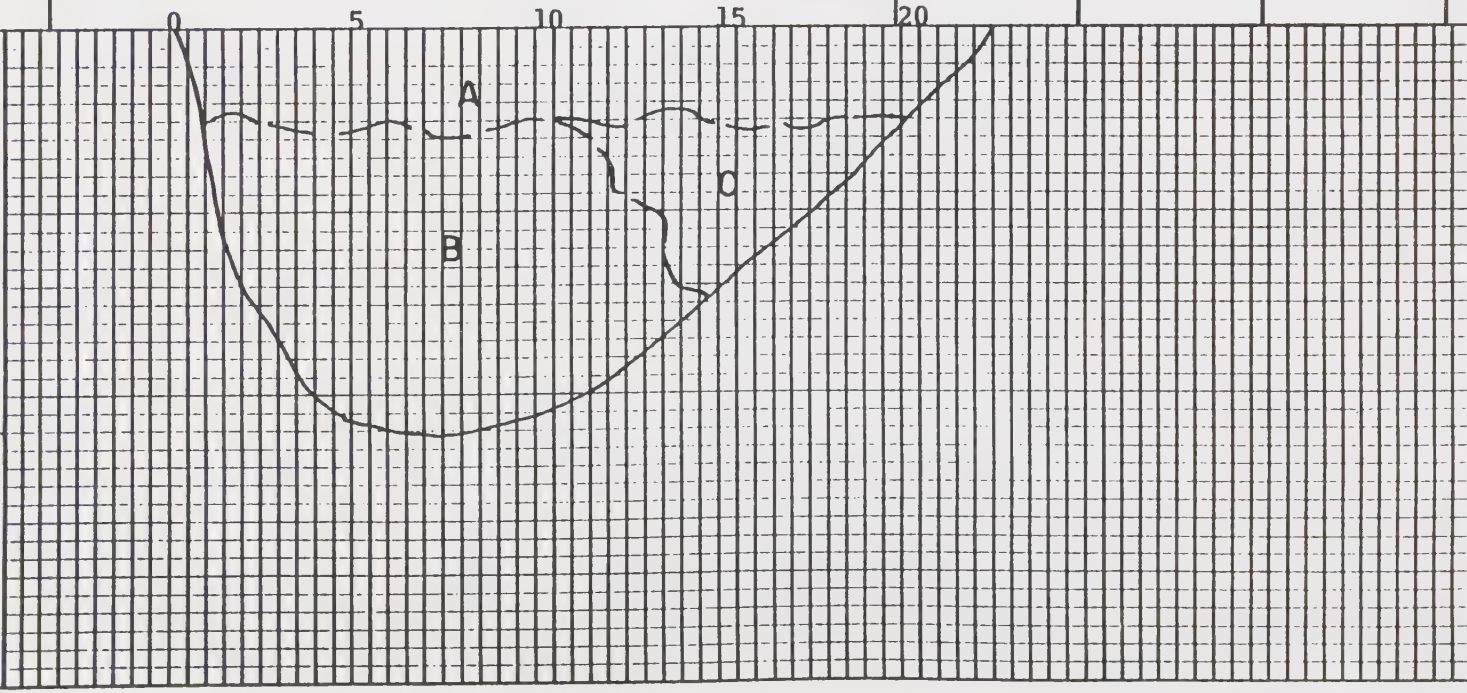
NATURAL SLOPE

ANGLE ← 13°

T.D. 12'

ELEV. LOGGED BY RR DATE LOGGED 12/21/87

DEPTH	MATERIALS DESCRIPTION TYPE, COLOR, MOISTURE, CONSOLIDATION, ETC.	ATTITUDES BEDDING	 JOINTS	 FAULT or SHEAR	COMMENTS
0 - 2.5 (A)	Dark brown pebbly Clayey SILT; soft, moist, porous (topsoil)	none	none	none	
2.5-11.0 (B)	Mottled medium brown Gravelly, Clayey SILT; hard, dense, very hard digging	none	none	none	
2.5-7.0 (C)	Grey pebbly CLAY; dense, stiff	none	none	none	



SCALE

HORIZ. 1" = 5'

VERT. 1" = 5'

PIT ORIENTATION

N48E

NATURAL SLOPE

ANGLE 9°

T.D. 11'

TERRASEARCH INC.

TEST PIT LOG No. 13

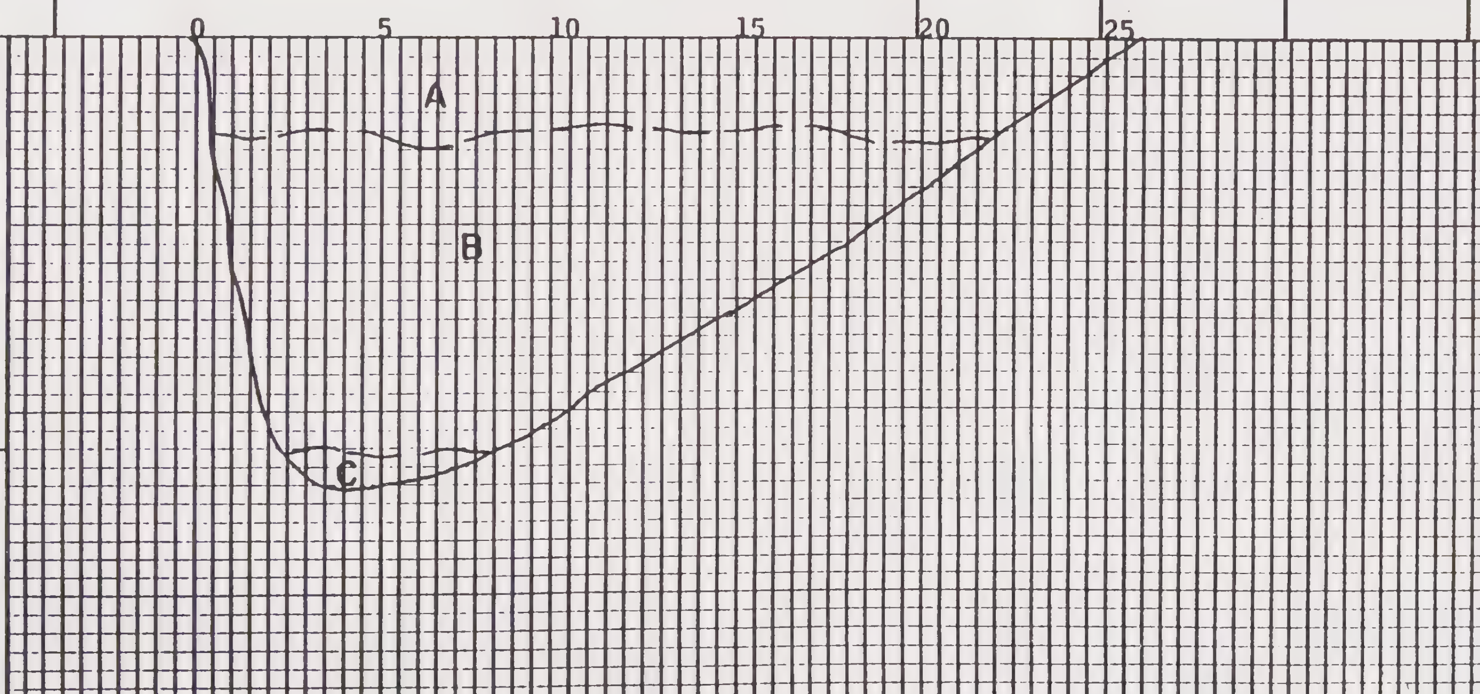
Figure No.

ELEV. LOGGED BY RR DATE LOGGED 12/21/87

DEPTH	MATERIALS DESCRIPTION TYPE, COLOR, MOISTURE, CONSOLIDATION, ETC.	ATTITUDES: BEDDING	ATTITUDES: JOINTS	ATTITUDES: FAULT or SHEAR	COMMENTS
0 - 2.5 (A)	Red brown pebbly Clayey SILT; soft, moist, porous (topsoil)	none	none	none	
2.5-11.0 (B)	Mottled medium brown Clayey Gravelly SILT grading locally to Clayey Silty GRAVEL; very hard, dense (old slide debris); very hard to excavate	none	none	none	
11.0-12.0 (C)	Tan Gravelly SAND, firm, dense	none	none	none	

TERRASEARCH INC.

TEST PIT LOG No. 14 Figure No.



SCALE

HORIZ. 1"—5'

VERT. 1"—5'

PIT ORIENTATION

N53E

NATURAL SLOPE

ANGLE 13°

T.D. 12'

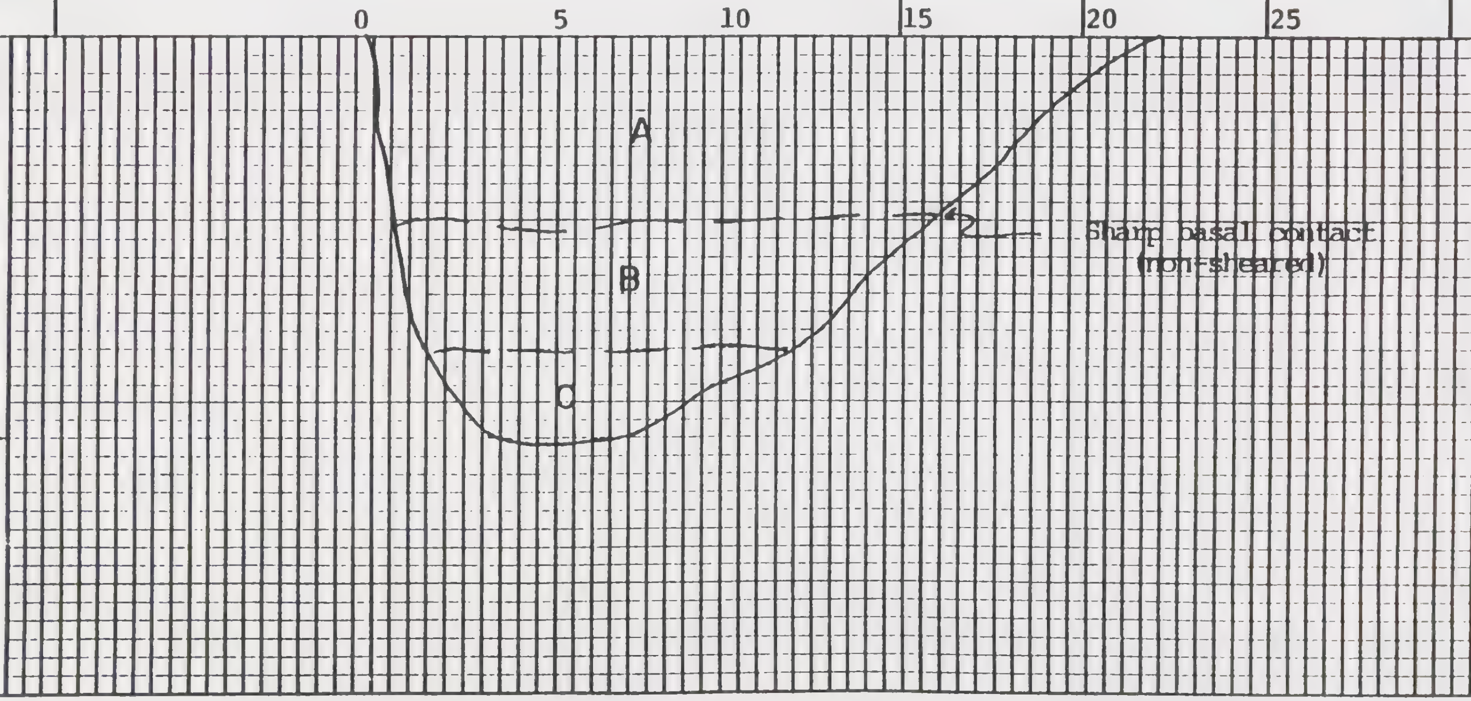
ELEV. LOGGED BY DATE LOGGED

DEPTH	MATERIALS DESCRIPTION TYPE, COLOR, MOISTURE, CONSOLIDATION, ETC.	ATTITUDES BEDDING	JOINTS	FAULT or SHEAR	COMMENTS
0 - 5.0 (A)	Reddish brown Gravelly SILT; loose, soft (slope-wash or alluvium); grades to tan Silt at base; lower contact is sharp but not sheared	none	none	none	
5.0-8.5 (B)	Dark brown Gravelly Clayey SILT (Paleosoil) hard, dense; appears to be old topsoil on ancient slide debris; angular clasts of dark grey SHALE	none	none	none	
8.5-11.0 (C)	Mottled medium brown Gravelly Clayey SILT; very hard and dense; hard digging (old dormant slide debris)	none	none	none	

TERRASEARCH INC.

TEST PIT LOG No. 15

Figure No.



SCALE

HORIZ. 1"—5'

VERT. 1"—5'

PIT ORIENTATION

N39E

NATURAL SLOPE

ANGLE 1°

T.D. 11'

ELEV.

LOGGED BY RR

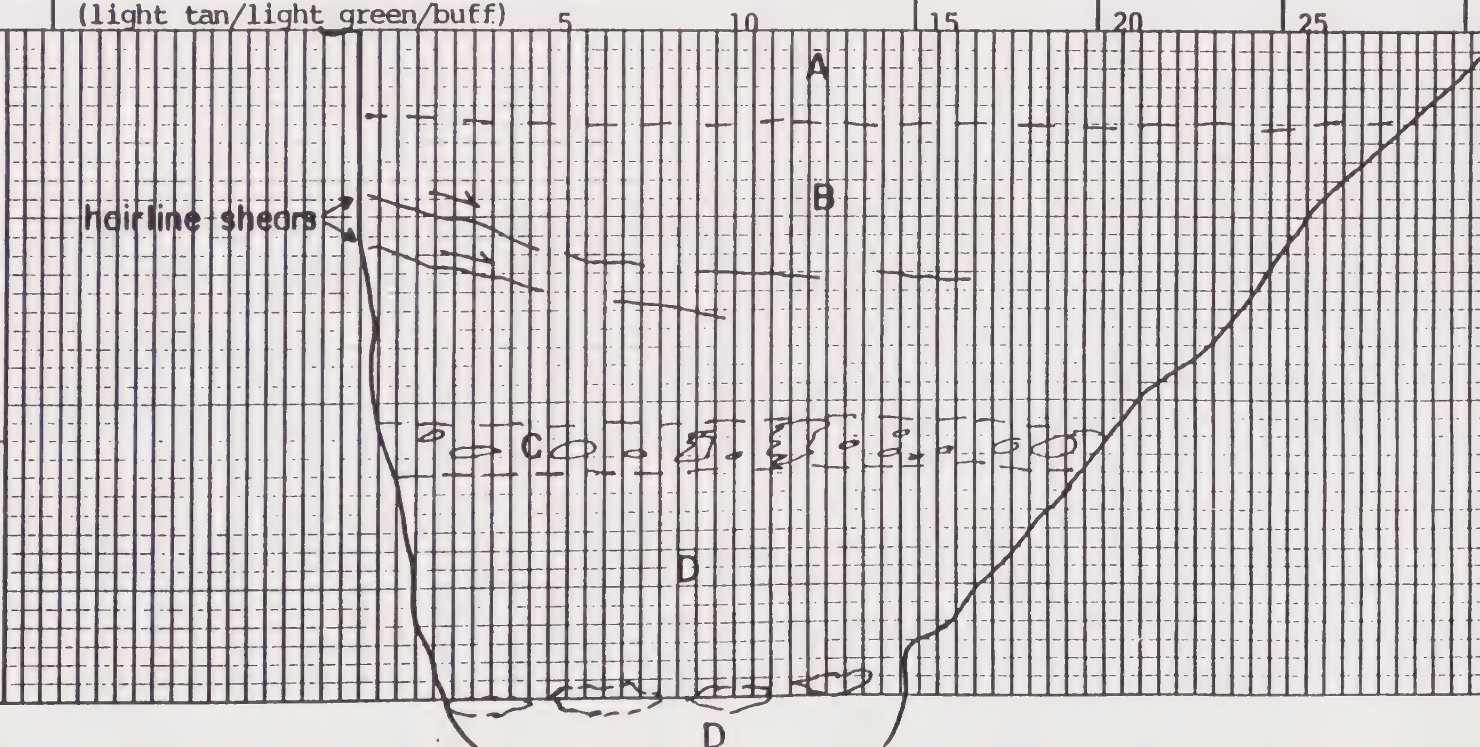
DATE LOGGED 10/12/90

DEPTH	MATERIALS DESCRIPTION TYPE, COLOR, MOISTURE, CONSOLIDATION, ETC.	ATTITUDES BEDDING	 JOINTS	 FAULT or SHEAR	COMMENTS
0-2.5' (A)	Mottled dark brown Gravelly Silty CLAY (poorly developed topsoil)	none	none	?	Located on small landslide lobe
2.5-10.5 (B)	Medium/dark brown w/reddish brown zones Gravelly Silty CLAY (SLIDE DEBRIS) w/planar slickensided hairline shears	none	none	dip 10-30 deg. easterly w/ slick. downdip	
10.5-12.0' (C)	Horizon w/subangular boulders Sandstone and well-rounded pebbles and cobbles hard metamorphic rock	none	none		
12.0-21.0' (D)	Mottled medium/dark brown but darker than (B) Pebbly Silty CLAY, dense, slightly moist w/shear planes (OLDER SLIDE DEBRIS). Zone of soft weathered varicolored metamorphic and volcanic rock at 19' (light tan/light green/buff)	none	none	?	

TERRASEARCH INC.

TEST PIT LOG No. 16

Figure No.



SCALE

HORIZ. 1" = 5'

VERT. 1" = 5'

PIT ORIENTATION

N70E

NATURAL SLOPE

ANGLE 17 deg.

T.D. 21'

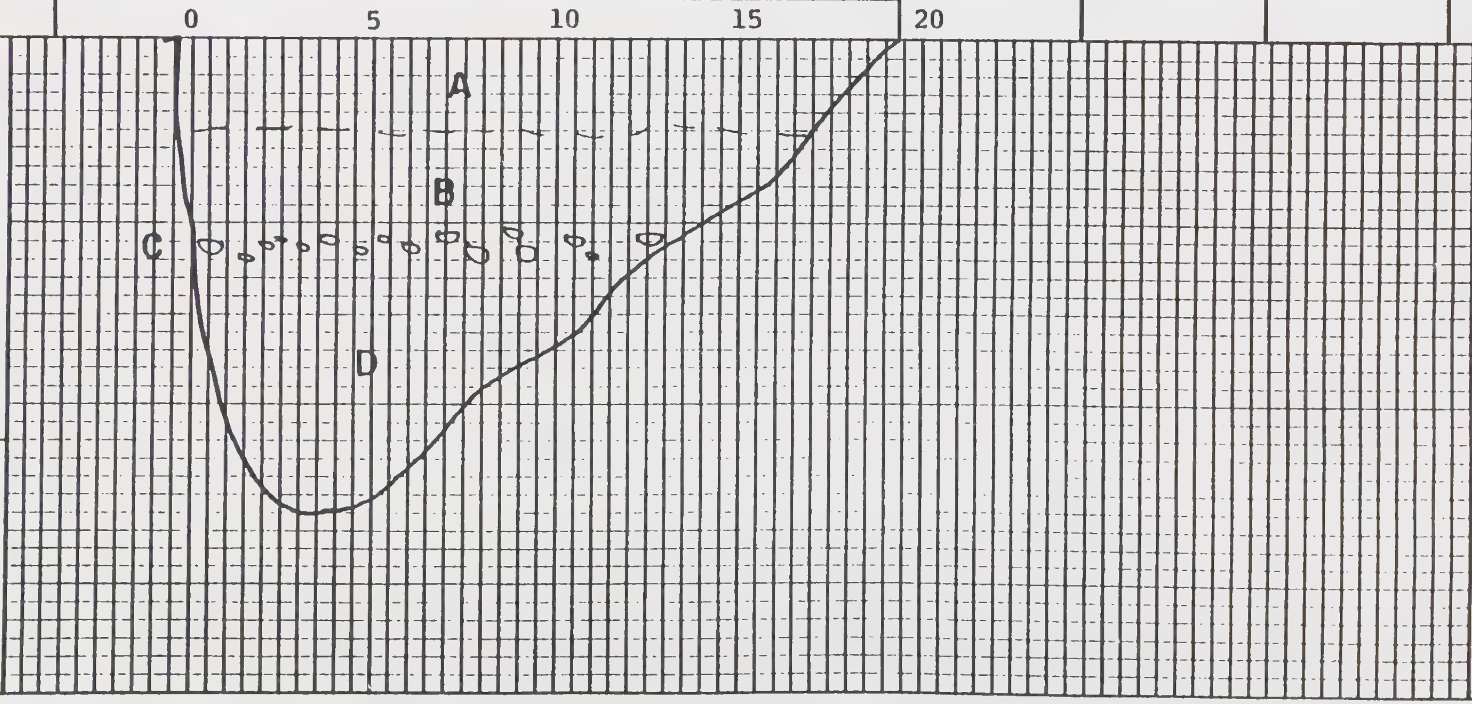
LOGGED BY DATE LOGGED

DEPTH	MATERIALS DESCRIPTION TYPE, COLOR, MOISTURE, CONSOLIDATION, ETC.	ATTITUDES BEDDING	 JOINTS	 FAULT or SHEAR	COMMENTS
0-2.5' (A)	Light brown Pebbly Clayey SILT, dry, loose	none	none	none	
2.5-5.0' (B)	Medium brown Pebbly Sandy Clayey SILT, firm, slightly moist	none	none	none	
5.0-6.0' (C)	Cobble/Pebble Horizon	subparallel to surface	none	none	
6.0-13.0' (D)	Pebbly Silty CLAY; dense, stiff, moist, irregular slickensided partings; reddish brown color; grades downward to Sandy Pebbly Clayey SILT (OLD SLIDE DEBRIS)	none	none	irreg.	

TERRASEARCH INC.

TEST PIT LOG No. 17

Figure No.



SCALE

HORIZ. 1"=5'

VERT. 1"=5'

PIT ORIENTATION

N30E

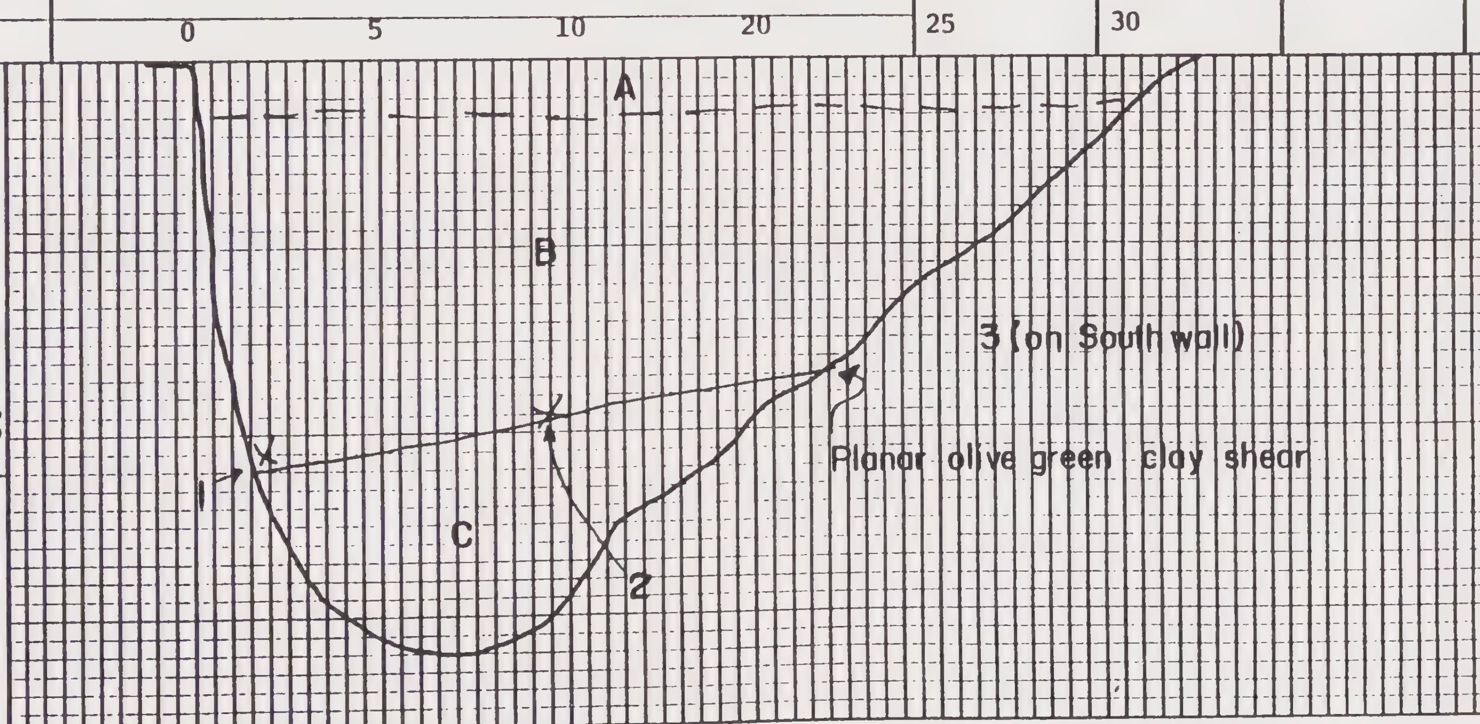
NATURAL SLOPE

ANGLE 13 deg.

T.D. 13'

ELEV. LOGGED BY RR DATE LOGGED 10/12/90

DEPTH	MATERIALS DESCRIPTION TYPE, COLOR, MOISTURE, CONSOLIDATION, ETC.	ATTITUDES BEDDING	ATTITUDES JOINTS	ATTITUDES FAULT or SHEAR	COMMENTS
0-1.5' (A)	Light brown Clayey SILT, dry, loose	none	none	none	Planar slickensided shear exposed along entire length of pit is landslide origin but does not relate to existing topography
1.5-11.0' (B)	Mottled medium brown Pebbly Clayey SILT: dense, stiff, slightly moist; lower contact is planar shear	none	none	moderate to steep dip NW/w subhoriz. slicks	
11.0-16.0' (C)	Red brown Gravelly Silty CLAY; dense, stiff, slightly moist to moist; scattered well rounded cobbles; scattered planar shear partings (OLDER SLIDE DEBRIS)	none	none		N35E, 63N (1) N44E, 30N (3) slicks plunge 3 deg. N25E (2) N37E 60 N slicks plunge 3 degrees N30E



TERRASEARCH INC.

TEST PIT LOG No. 18

Figure No.

SCALE

HORIZ. 1"=5'

VERT. 1"=5'

PIT ORIENTATION

N37E

NATURAL SLOPE

ANGLE 11 deg.

T.D. 16'

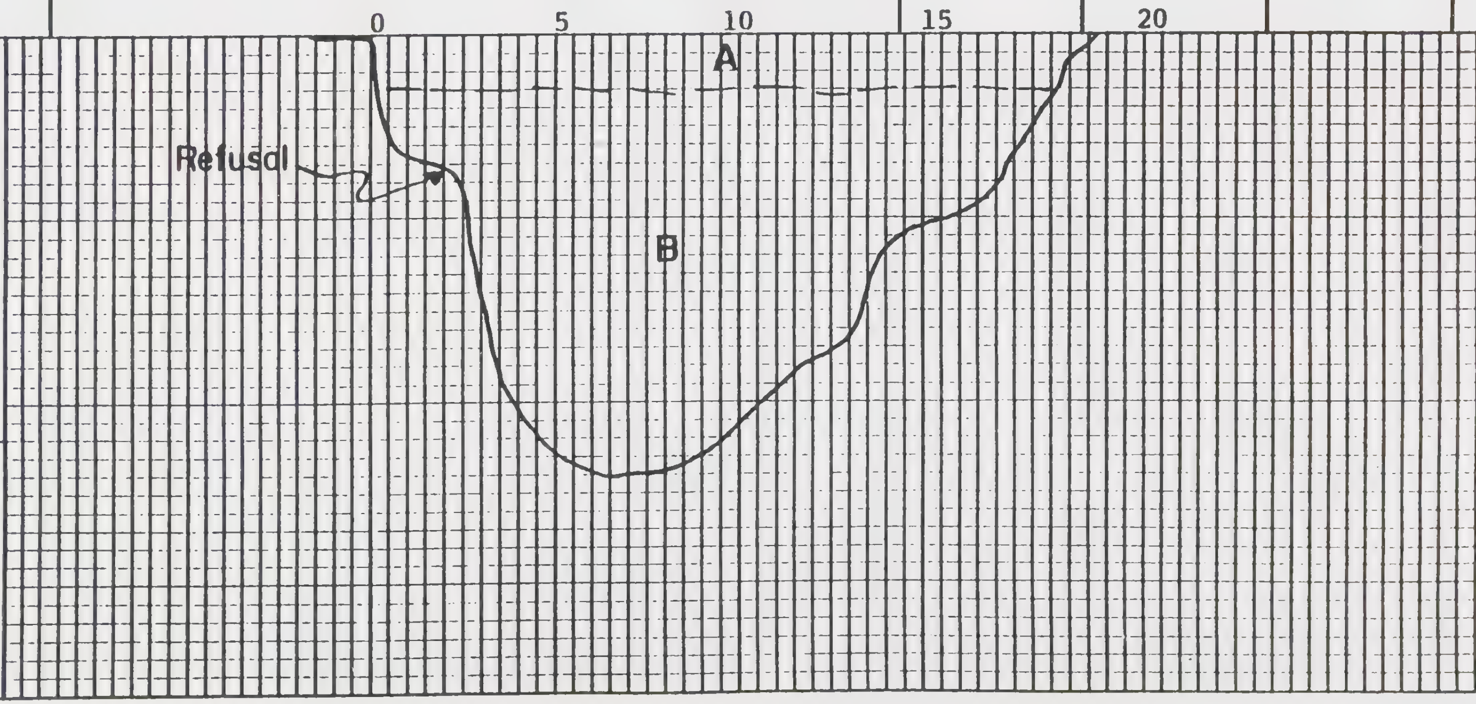
ELEV. LOGGED BY RR DATE LOGGED 10/12/90

DEPTH	MATERIALS DESCRIPTION TYPE, COLOR, MOISTURE, CONSOLIDATION, ETC.	ATTITUDES: BEDDING	ATTITUDES: JOINTS	ATTITUDES: FAULT or SHEAR	COMMENTS
0-1.5'	Light brown Pebbly Clayey SILT, dry, loose	none	none	none	
(A)					
1.5-12.0'	Mottled red brown bouldery Clayey GRAVEL and Gravelly	none	none	none	
(B)	Sandy CLAY; dense, stiff, slightly moist, very hard				
	digging (OLD SLIDE DEBRIS); boulders to 2.5' diameter				

TERRASEARCH INC.

TEST PIT LOG No. 19

Figure No.



SCALE

HORIZ. 1" = 5'

VERT. 1" = 5'

PIT ORIENTATION

N6E

NATURAL SLOPE

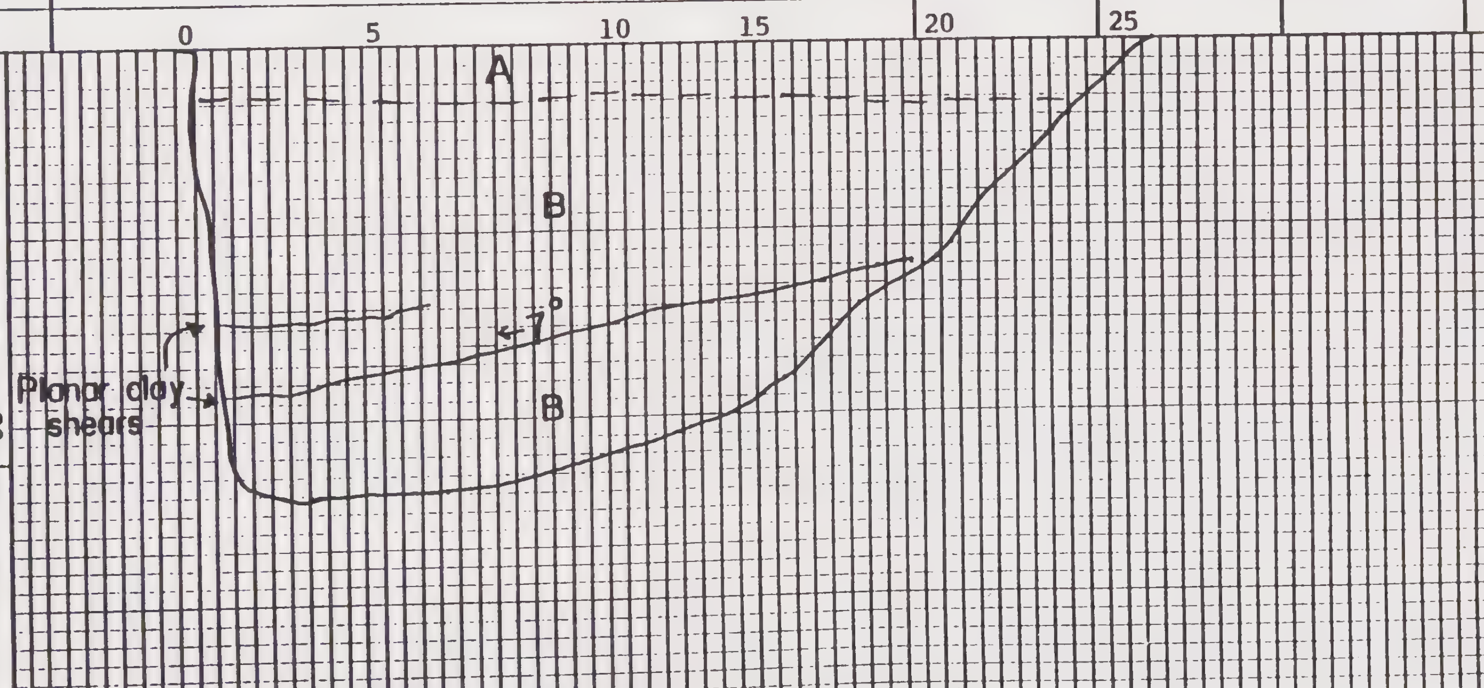
18 deg.

ANGLE

T.D. 12'

ELEV. LOGGED BY RR DATE LOGGED 10/12/90

DEPTH	MATERIALS DESCRIPTION TYPE, COLOR, MOISTURE, CONSOLIDATION, ETC.	ATTITUDES BEDDING	 JOINTS	 FAULT or SHEAR	COMMENTS
0-1.5'	Light brown Pebbly Clayey SILT, dry, loose	none	none	none	
(A)					
1.5-12.0'	Medium brown Pebbly Sandy CLAY w/planar hairline	none	none	N15E, 10W	
(B)	shears coated w/moist olive green CLAY (OLD SLIDE				
	DEBRIS): dense, stiff, slightly moist				



TERRASEARCH INC.

TEST PIT LOG No. 20

Figure No.

SCALE

HORIZ. 1" = 5'

VERT. 1" = 5'

PIT ORIENTATION

N50E

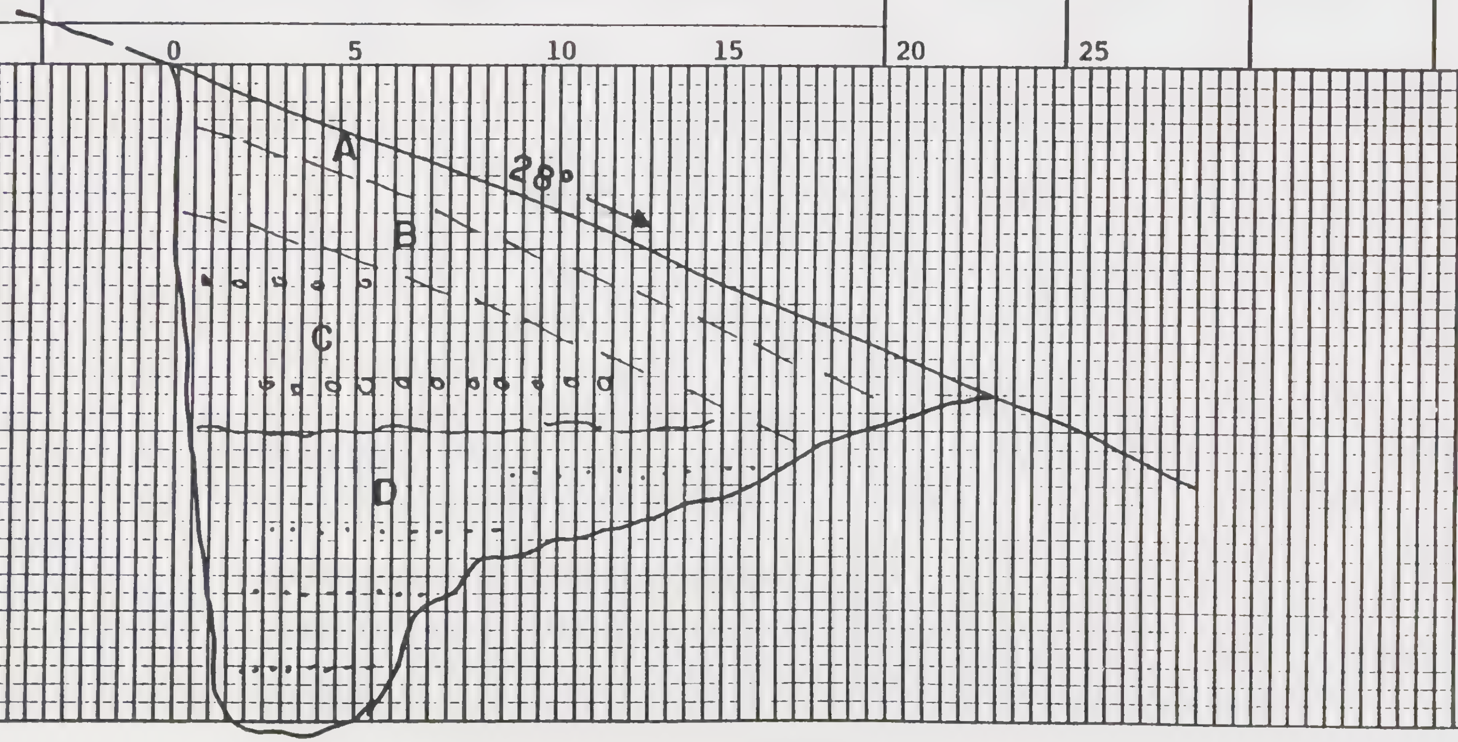
NATURAL SLOPE

ANGLE 10 Deg.

T.D. 12'

ELEV. LOGGED BY DATE LOGGED

DEPTH	MATERIALS DESCRIPTION TYPE, COLOR, MOISTURE, CONSOLIDATION, ETC.	ATTITUDES BEDDING	 JOINTS	 FAULT or SHEAR	COMMENTS
0-1.5' (A)	Light brown Pebbly Clayey SILT, dry, loose	none	none	none	Located in shallow slump zone
1.5-4.0' (B)	Medium brown Pebbly Silty CLAY (SHALLOW SLIDE DEBRIS)	none	none	none	
4.0-10.0' (C)	GRAVEL: rounded pebbles up to 3" diameter (QTl?): loose subhorizontal bedding, irregular sharp basal contact appears depositional but w/local clay partings	subhor.	none	none	
10.0-18.5' (D)	Light grey green to light tan SILTSTONE and very fine SANDSTONE; shell-fragment horizons (Tps)	subhor. and massive	none	none	



TERRASEARCH INC.

TEST PIT LOG No. 21

Figure No.

SCALE

HORIZ. 1" = 5'

VERT. 1" = 5'

PIT ORIENTATION

Due E

NATURAL SLOPE

ANGLE 28 deg.

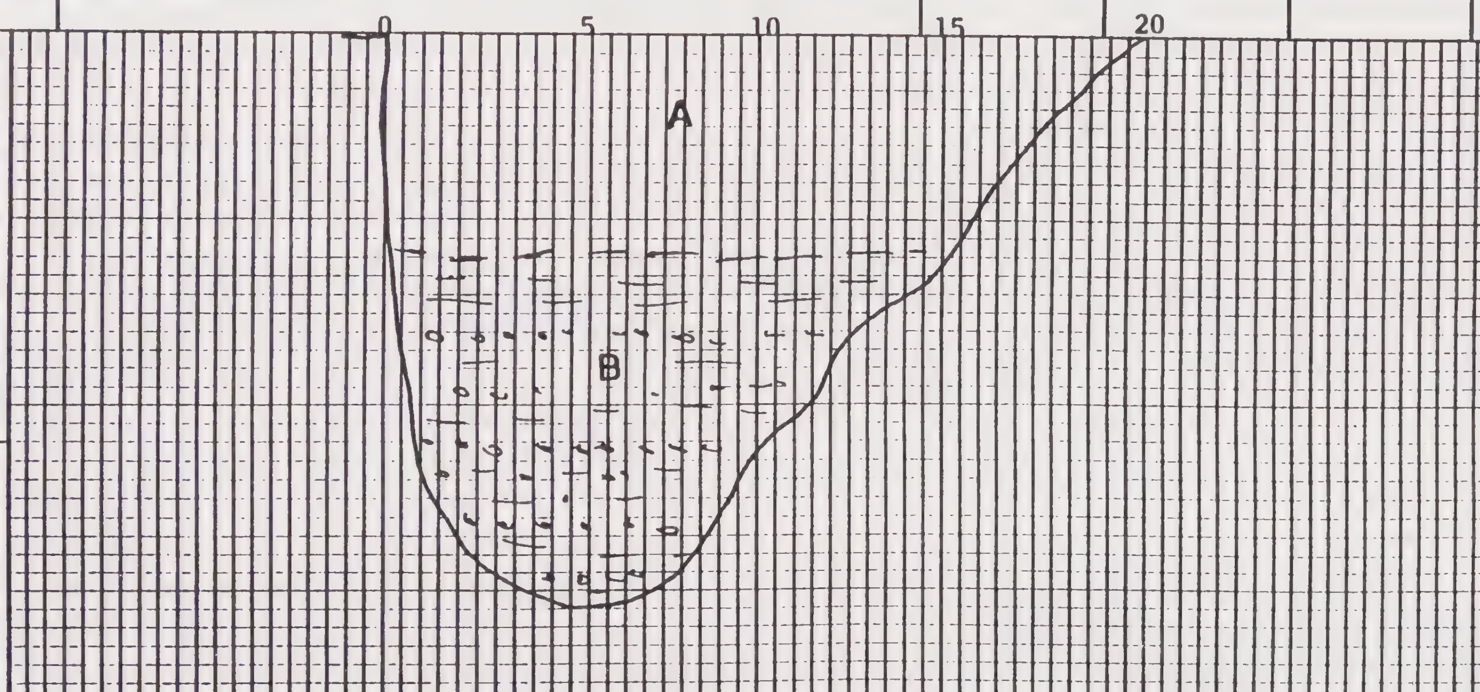
T.D. 18.5'

ELEV.

LOGGED BY RR

DATE LOGGED 10/15/90

DEPTH	MATERIALS DESCRIPTION TYPE, COLOR, MOISTURE, CONSOLIDATION, ETC.	ATTITUDES BEDDING	 JOINTS	 FAULT or SHEAR	COMMENTS
0-6.0'	Medium brown Pebbly Silty CLAY: slightly moist to	none	none	?	
(A)	moist; soft to firm (recent Slide Debris-shallow)				
6.0-15.5'	Thinly interbedded red brown and light grey brown	N65E, 5NW	none	none	
(B)	SAND and GRAVEL w/minor light grey Clayey SILT (QTl),				
	firm to soft, moist; poorly consolidated to loose				



TERRASEARCH INC.

TEST PIT LOG No. 22

Figure No.

SCALE

HORIZ. 1" = 5'

VERT. 1" = 5'

PIT ORIENTATION

N75E

NATURAL SLOPE

ANGLE 17 deg.

T.D. 15.5'

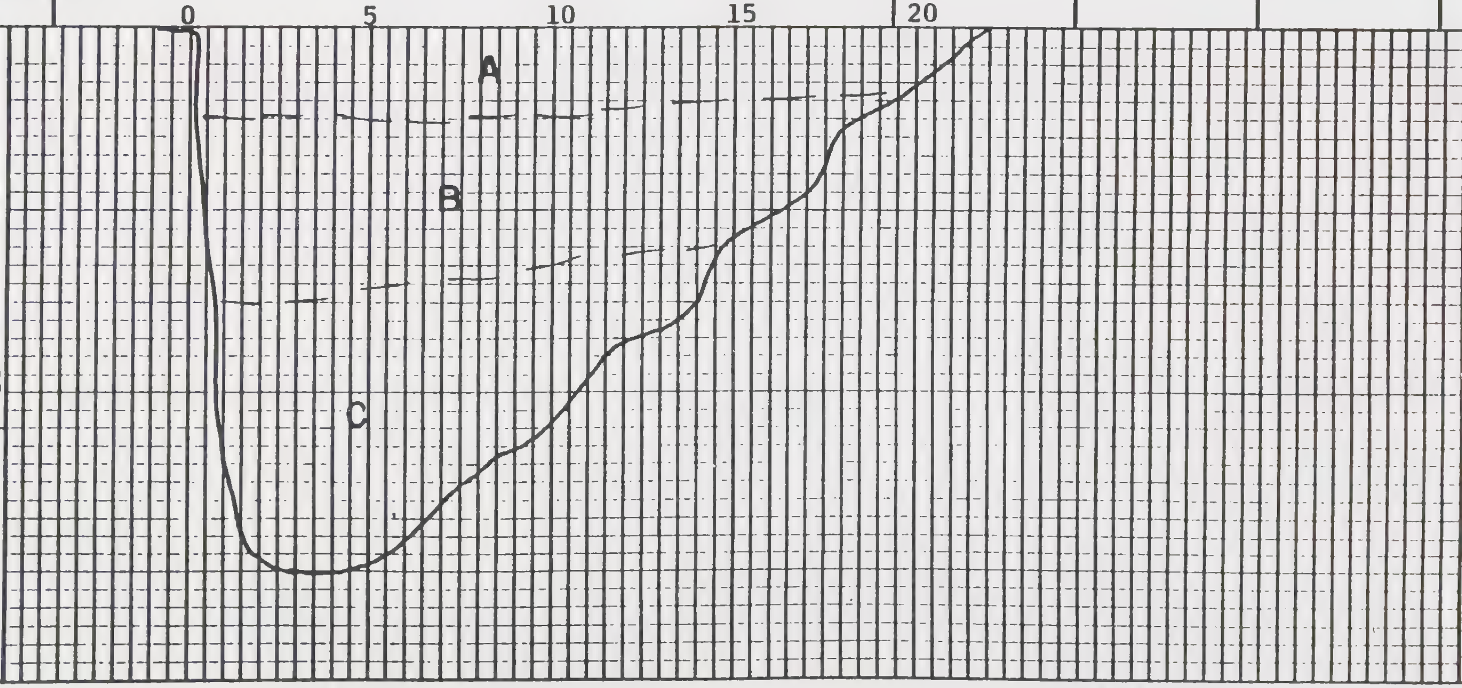
ELEV. LOGGED BY DATE LOGGED

DEPTH	MATERIALS DESCRIPTION TYPE, COLOR, MOISTURE, CONSOLIDATION, ETC.	ATTITUDES: BEDDING	ATTITUDES: JOINTS	ATTITUDES: FAULT or SHEAR	COMMENTS
0-2.5' (A)	Medium grey brown Clayey SILT, dry, loose, porous	none	none	none	
2.5-7.5' (B)	Interbedded tan and red brown Gravelly CLAY, Gravelly SAND and Clayey GRAVEL (Col. or QTl)	shallow north dip	none	none	
7.5-15.0' (C)	Light olive drab Clayey SILTSTONE: irregular caliche seams; firm, slightly moist (QTl)	massive	none	none	

TERRASEARCH INC.

TEST PIT LOG No. 23

Figure No.



SCALE

HORIZ. 1" = 5'

VERT. 1" = 5'

PIT ORIENTATION

Due N

NATURAL SLOPE

ANGLE 23 deg.

T.D. 15'

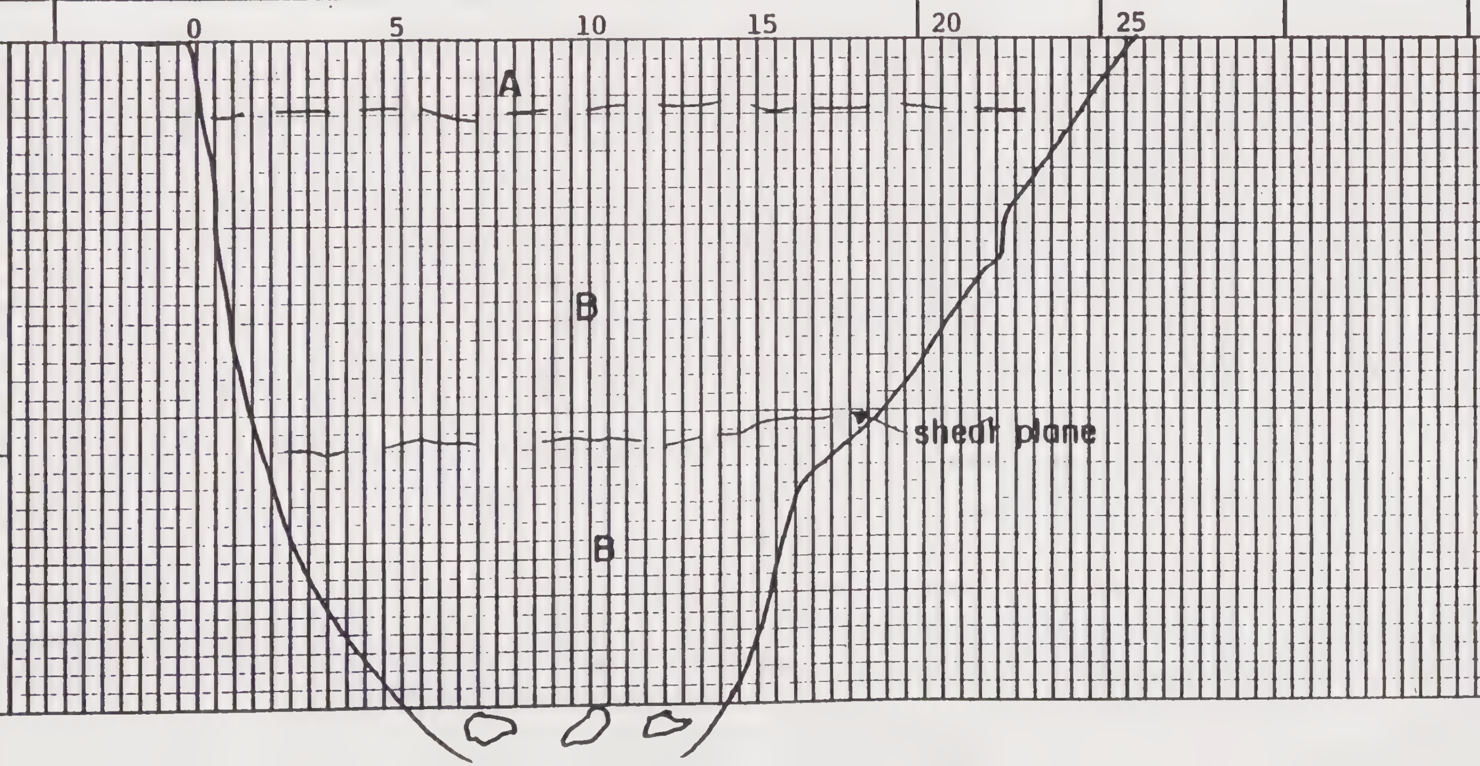
ELEV. LOGGED BY RR DATE LOGGED 10/15/90

DEPTH	MATERIALS DESCRIPTION TYPE, COLOR, MOISTURE, CONSOLIDATION, ETC.	ATTITUDES			COMMENTS
		BEDDING	JOINTS	FAULT or SHEAR	
0-2.0' (A)	Medium to light brown Pebbly Clayey SILT (dry, loose porous) (TOPSOIL)	none	none	none	
2.0-21.0' (B)	Mottled medium brown and red brown w/grey green seams Pebbly to locally Gravelly CLAY (OLD SLIDE DEBRIS): slickensided shear planes; large subangular boulders near bottom	none	none	wavy shear plane at 11' w/ slickensides plunging 10 deg. N40E	10 deg. @ 11' depth N40E

TERRASEARCH INC.

TEST PIT LOG No. 24

Figure No.



SCALE

HORIZ. 1" = 5'

VERT. 1" = 5'

PIT ORIENTATION

N78E

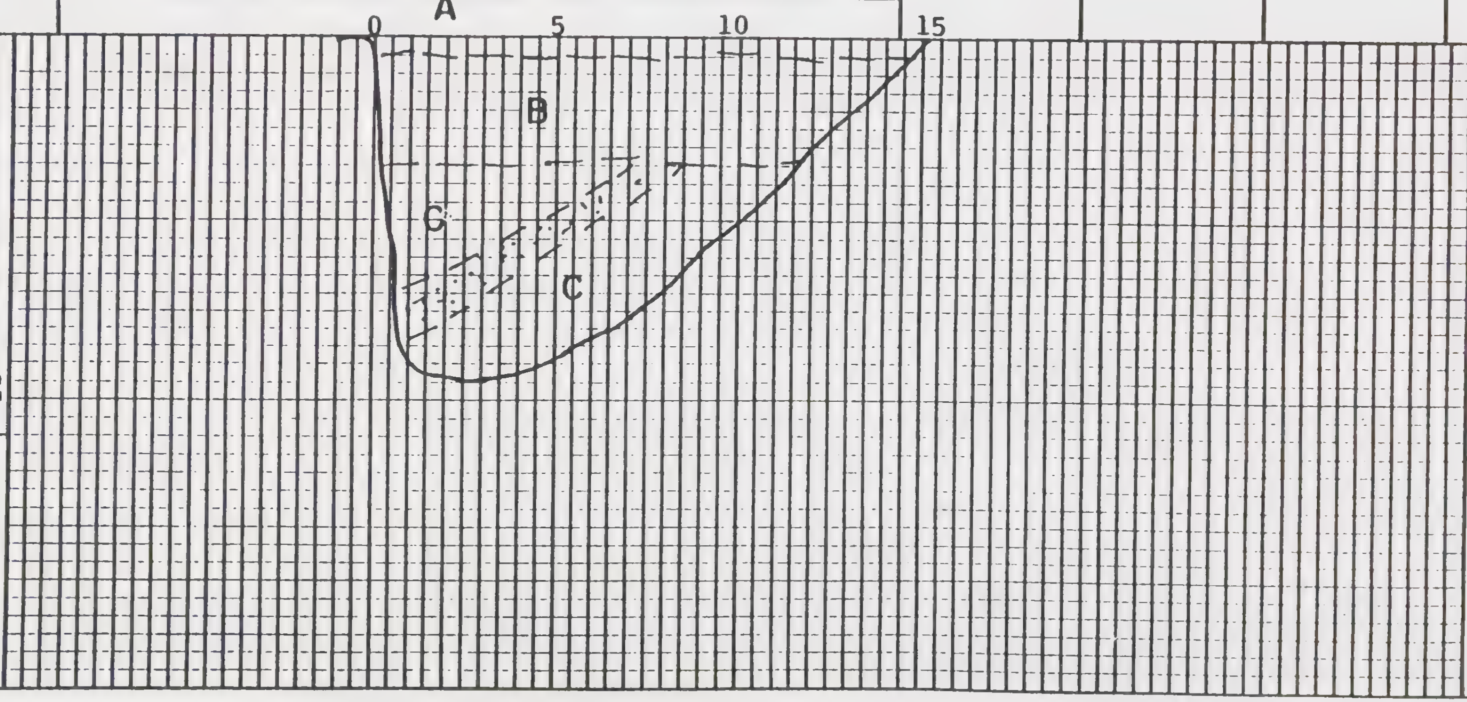
NATURAL SLOPE

ANGLE 22 deg.

T.D. 21'

ELEV. LOGGED BY RR DATE LOGGED 10/15/90

DEPTH	MATERIALS DESCRIPTION TYPE, COLOR, MOISTURE, CONSOLIDATION, ETC.	ATTITUDES: BEDDING	ATTITUDES: JOINTS	ATTITUDES: FAULT or SHEAR	COMMENTS
0-0.5' (A)	Light brown Pebbly Clayey SILT: dry, loose, porous	none	none	none	
0.5-3.5' (B)	Medium brown Pebbly Silty CLAY; moist, soft to stiff (col.)	none	none	none	
3.5-9.5' (C)	Light olive drab massive Clayey calichified SILTSTONE w/1' horizon of red brown Sand at 7' (QTl or Tps)	N45W 6NE	none	none	



TERRASEARCH INC.

TEST PIT LOG No. 25

Figure No.

SCALE

HORIZ. 1" = 5'

VERT. 1" = 5'

PIT ORIENTATION

N55E

NATURAL SLOPE

ANGLE 23 deg.

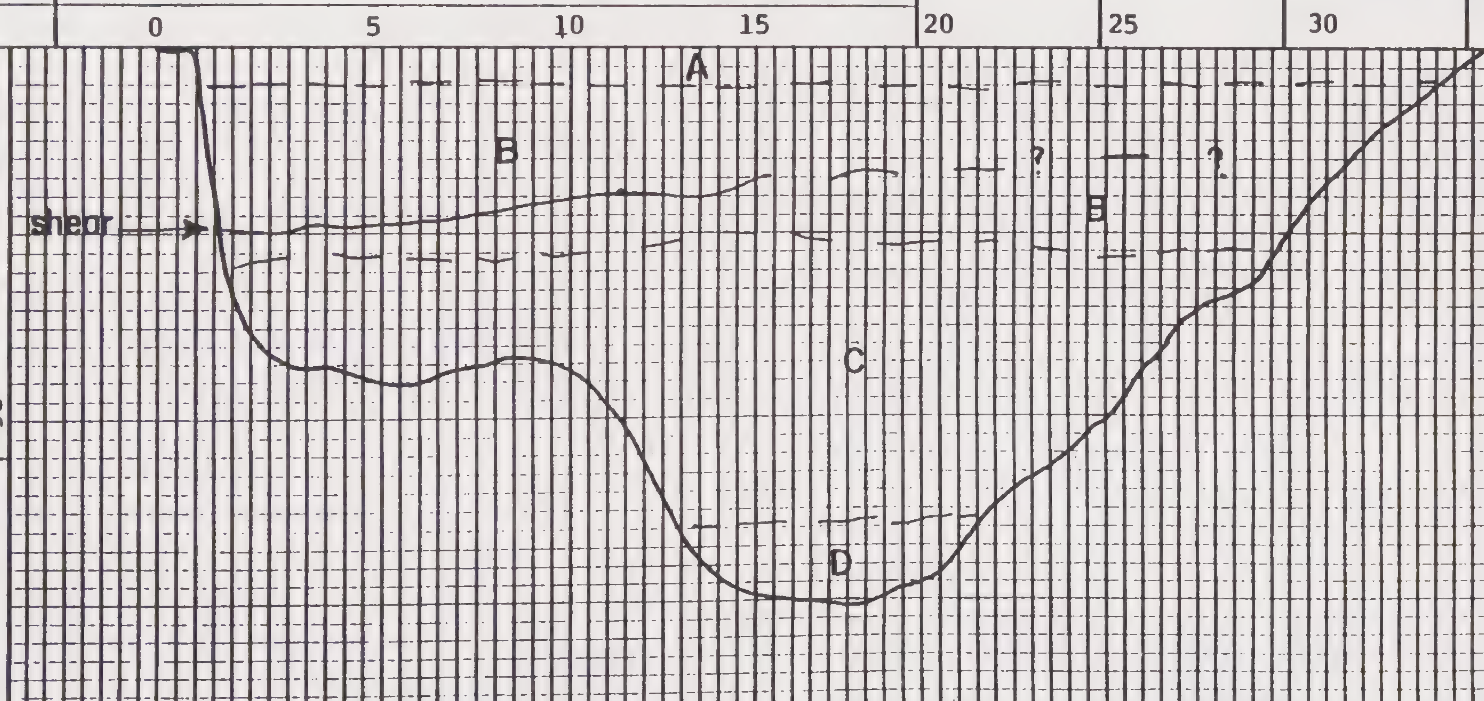
T.D. 9.5'

ELEV.

LOGGED BY RR

DATE LOGGED 10/15/90

DEPTH	MATERIALS DESCRIPTION TYPE, COLOR, MOISTURE, CONSOLIDATION, ETC.	ATTITUDES BEDDING	 JOINTS	 FAULT or SHEAR	COMMENTS
0-1.0' (A)	Light brown Pebbly Clayey SILT, dry, loose, porous topsoil)	none	none	none	
1.0-5.0' (B)	Medium brown Pebbly to Gravelly Silty CLAY: slightly moist to moist, stiff (Qlo)	none	none	subparallel to surface	
5.0-13.0' (C)	Boulder GRAVEL and Gravelly CLAY: dense, very hard digging: boulders to 2.5' in matrix of Sandy Pebbly CLAY (probably Qlo)	? sub-parallel to surface	none	none	
13.0-15.0' (D)	Varicolored blue-grey to dark red brown Pebbly CLAY: well-rounded pebbles and cobbles to 5" diameter in matrix of soft moist CLAY (may be QTl)	massive	none	?	



TERRASEARCH INC.

TEST PIT LOG No. 26

Figure No.

SCALE

HORIZ. 1"=5'

VERT. 1"=5'

PIT ORIENTATION

N57E →

NATURAL SLOPE

ANGLE 11 deg. →

T.D. 15'

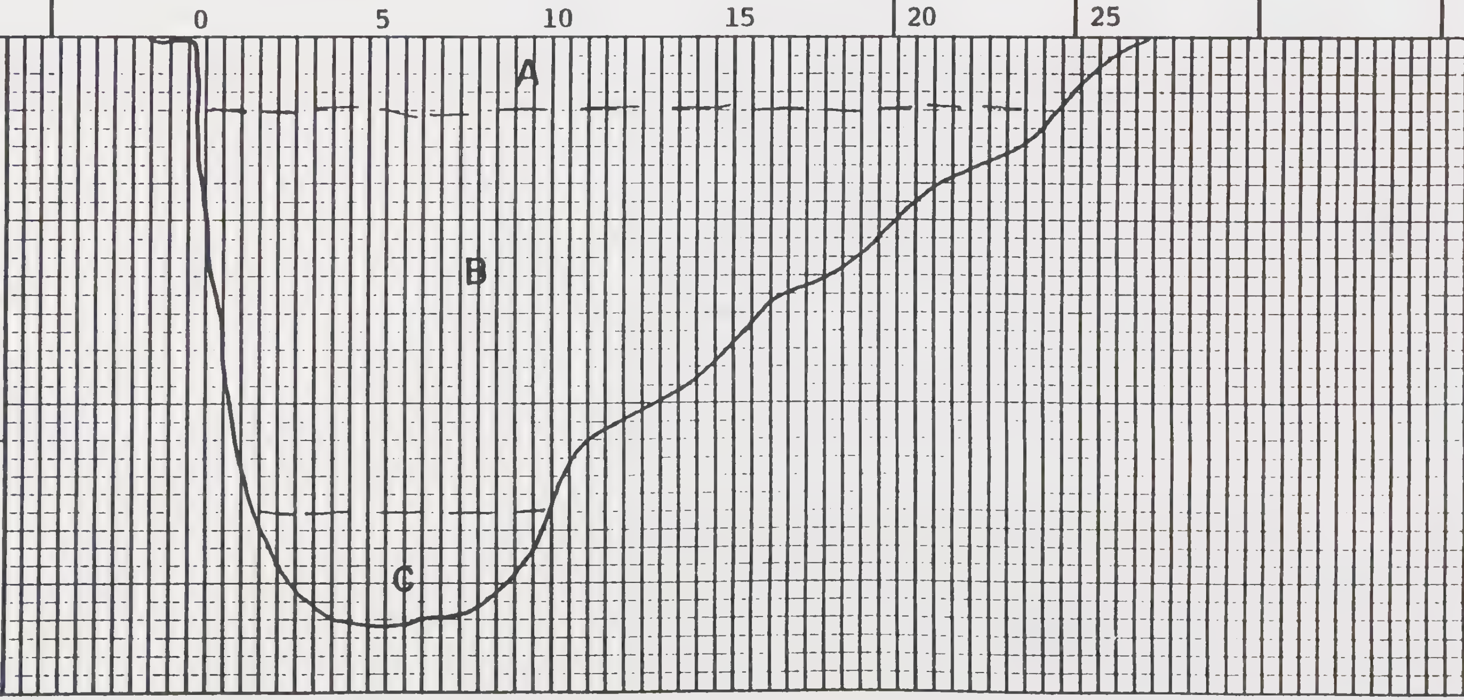
ELEV. LOGGED BY RR DATE LOGGED 10/15/90

DEPTH	MATERIALS DESCRIPTION TYPE, COLOR, MOISTURE, CONSOLIDATION, ETC.	ATTITUDES			COMMENTS
		BEDDING	JOINTS	FAULT or SHEAR	
0-2.0' (A)	Light to medium brown Pebbly Clayey SILT: dry to slightly moist, loose to firm	none	none	none	
2.0-13.0' (B)	Red brown to dark greenish brown Pebbly to Gravelly CLAY; slickensided shear planes; scattered angular boulders (OLD SLIDE DEBRIS)	none	none	sub-parallel to surface	
13.0-16.0' (C)	Light olive green Clayey SILTSTONE: soft, moist, abundant irregular caliche seams (QTl or Tps bedrock)	massive	none	none	

TERRASEARCH INC.

TEST PIT LOG No. 27

Figure No.



SCALE

HORIZ. 1" = 5'

VERT. 1" = 5'

PIT ORIENTATION

N50W

NATURAL SLOPE

ANGLE 18 deg.

T.D. 16'

Alan Kropp, CE, GE
Steven Kokihara, CE, GE
Garreth Saiki, CE
Jerrold Hanson, CE

ALAN KROPP & ASSOCIATES, INC. GEOTECHNICAL CONSULTANTS

December 9, 1996
1696-2, L 21259

DEC 10 1996

RECEIVED
DEC 1 0 1996
CITY OF PLEASANTON
PLANNING DEPT.

Mr. Roger Higdon
City of Pleasanton
123 Main Street
Pleasanton, CA 94566

RE: Geotechnical/Geological Peer Review
Proposal Hillside Lot Studies
Oak Tree Farm, Tract 6898
Pleasanton, California

Dear Mr. Higdon:

In accordance with your request, we have conducted a geotechnical and geological engineering peer review services of new studies which have recently been performed for the proposed hillside lots in the existing Oak Tree Farm Subdivision. This subdivision is located along Foothill Road in Pleasanton, California, and the hillside lots are designated Tract 6898.

The eastern portion of the Oak Tree Farm Subdivision consists of two tracts (Tracts 6563 and 6748) of homes currently being constructed on nearly level ground at the base of the large slope which occupies the western two-thirds of the subdivision limits. The proposed hillside lots are located on or near the base of the large slope in two areas. Parcel A and Lots 1 to 4 are located near the base of the slope at the southern boundary of the subdivision (and are called collectively the "southern lots" in this report). Lots 5 through 14 are proposed within the sloping hillside area along the northern subdivision limits (and are called the "northern lots" in this report). The purpose of our peer review was to provide an assessment of the conformance of the recent studies to generally accepted geotechnical and geological engineering practices as well as to provide information to the City of Pleasanton to help guide the City in their consideration of approval of these new hillside lots.

BACKGROUND

The hillside portion of the Oak Tree Farm Subdivision is located within a massive, deep-seated, ancient landslide complex called the Castlewood Landslide Complex. This landslide ranges between about 2000 to 4000 feet wide and extends along the base of Pleasanton Ridge for about 3 miles. Previous studies of the stability of this ancient landslide within the Oak Tree Farm subdivision limits were performed between 1987 and 1992. However, disagreements regarding the hill stability between the geotechnical consultants

for the developer and the peer reviewers for the City of Pleasanton led to a suspension of consideration of development of the hillside lots until this fall. At that time, significantly more sophisticated studies of the ancient landslide stability were authorized by the project developer (along with updating and further evaluating other geotechnical aspects of the project) and the City engaged us to provide a peer review of these new analyses.

SCOPE

To accomplish our peer review services, we have performed the following activities:

1. Reviewed published geotechnical and geological engineering materials regarding slope stability analyses;

2. Reviewed past geotechnical reports for other recent residential subdivision projects within the Castlewood Landslide Complex, (many of which were peer-reviewed by Alan Kropp and Associates on behalf of Alameda County);

3. Discussed the complex slope stability analyses techniques needed on a project such as this with several well-recognized university professors;

4. Visited the site on several occasions to observe the surficial conditions;

5. Monitored drilling operations of supplemental borings at the site;

6. Participated in five meetings with representatives of the geotechnical consultants for the project developer; and

7. Reviewed a large number of documents which were prepared by various engineering consultants for the developer or the City related to the Oak Tree Farm Subdivision. Most importantly, this included two recent reports which culminated the recent studies. These were:

    a. "Geologic and Geotechnical Update for Analysis of Hillslope Lot Development, Oak Tree Farm, Tract 6898, Foothill Road, Pleasant Hill, California," prepared by Terrasearch, Inc., for Currin Construction Company, dated November 19, 1996, Project No. 5541

    b. "Stability Analyses of Ancient Landslide, Oak Tree Farm, Tract 6898, Foothill Road, Pleasanton, California," prepared by Kleinfelder, Inc., for Currin Construction Company, dated November 25, 1996, File No. 10-3004-64

FINDINGS

Two distinct and separate issues have been addressed at the site:

1. Assessment of the ancient Castlewood Landslide, and

2. Assessment of recent landslides.

Below, we first discuss our review of the static and dynamic stability of the ancient landslide. We conclude that the studies conducted to date indicate an adequate factor of safety for the proposed development. Second, we discuss our review of the recent landslides. We conclude that, although the proposed development is technically feasible, significant grading will be required to mitigate the recent landslides.

ANCIENT LANDSLIDE

1. General

The Castlewood Landslide Complex underlies nearly all of the lots under consideration. The only exceptions are Lots 2, 3, and 14, although the toe of the landslide complex encroaches slightly into the northwestern corner of Lot 3 and along the western property margin of Lot 14. A series of meetings were conducted with representatives of Terrasearch, Inc. (TI), and Kleinfelder, Inc. (KI), to discuss the general concepts, as well as the specific parameters, for how the stability of the ancient landslide might be analyzed in more detail than was done in past studies. Based on these meetings, TI and KI developed a new cross-section through the northern lots, which has been designated Cross-Section 12-12'. Based on our input during the development of this information, as well as our review of the section presented in the final reports, we are in general agreement with the characterization of the location of the slide plane for this deep-seated landslide shown on Cross-Section 12-12'.

The depth to groundwater and shear strength along the slide plane of this deep-seated landslide may be somewhat different in static (non-earthquake) conditions than in dynamic (earthquake) conditions. Therefore, these two environments will be discussed in separate sections below.

2. Static Stability

Our experience from reviewing other investigations within the Castlewood Landslide Complex is that borings in the landslide often encounter groundwater at depths of 10 to 40 feet below the ground surface. Although some borings have been drilled within the landslide complex which have not encountered groundwater (sometimes even at depths of 100 feet or greater), most borings have encountered groundwater. In the vicinity of the Castlewood Country Club, the high groundwater levels may be explained by the substantial

amount of irrigation watering for the golf course. However, similar high groundwater patterns have been encountered in the borings in the landslide areas north of the Country Club as well. It is therefore somewhat surprising that most borings drilled for the Oak Tree Farm Project have not encountered groundwater. The primary exception to this has been the upper borings (Borings 42, 52, and 53) where water at depths of approximately 40 feet was encountered. As noted by TI, this is an area of springs in the immediate vicinity of the Calaveras fault and thus the fault may represent a groundwater barrier in this area which in turn leads to high groundwater levels. Based on this data, the assumption of groundwater at a depth of approximately 30 feet uphill of this presumed fault location was discussed in our meetings with TI and KI and generally agreed upon as appropriate for analysis. Downslope of the fault, water was seldom encountered in borings for the Oak Tree Farm Subdivision and when it was encountered it generally was not above the presumed slide plane. Nonetheless, we do not believe that a major groundwater monitoring program has been performed which can document that groundwater does not develop above the level of the slide plane during winter conditions, particularly during heavy rainfall winters. Therefore, it is our opinion that the assumption we discussed with TI and KI that water can build up as much as 30 feet above the landslide slip plane is a reasonably conservative assumption and we believe this level is appropriate for the static stability analysis.

A variety of shear strength parameters were used in the analyses by TI and KI to characterize the strength along the slide plane of the ancient landslide under static conditions. Based on our experience and our research, we believe it is most appropriate to characterize shear strength for static analyses using only a residual friction angle and no cohesion. When this approach is used, a residual friction angle is used which is somewhat higher used than the friction angle used in conjunction with a small cohesion value. We should also note that the actual slide plane is quite variable in the descriptions provided on the boring logs. Considering that the landslide shear plane extends for approximately 4,000 feet within this project, it is very likely that the slip plane conditions are quite variable along the length of the slide plane. In many of the borings for other projects in the Castlewood Landslide Complex, the slip surface for the deep-seated landslide is very gravelly. Descriptions of gravelly materials were also reported on the boring logs for this project in some areas. Therefore, it is our opinion that the "average" strength value along the length of this long landslide shear surface is not reasonably characterized by the lowest shear strength value obtained on a clayey sample in one test. We believe it is likely that the residual friction angle will vary between approximately 15 degrees and 30 degrees along the length of this landslide. Reasonable back analysis of this landslide by TI indicates that the residual friction angle (assuming no cohesion) would have been between 24 and 48 degrees if a seismic coefficient (to simulate earthquake forces) were in the range of 0 to 0.32 (see Figure 7 of the TI report). (It should be noted that if a seismic coefficient of 0 is used, then no earthquake loads are being assumed to act and the analysis is for static conditions. As discussed later in this report, a seismic coefficient of 0.32 is considered extremely high for simulating a major earthquake in this area.) We have also reviewed a variety of other back analyses for other projects in the Castlewood Landslide Complex which indicate that the residual friction angle (assuming no cohesion) was in the range of 14 to 24 degrees (with a seismic coefficient of 0) and 30 to 40 degrees (with a seismic coefficient of 0.15 to 0.20). It should be noted that the various back analysis studies typically assumed a shallow to mid-depth groundwater level. Since it is widely believed that the initial movement of the landslide complex occurred during a wetter climate and when a large-magnitude earthquake occurred, the residual strength values related to earthquake loading

with reasonable seismic coefficients are probably reasonably good characterizations of the shear strength along the slip plane. However, it should be noted that the initial failure of the landslide may have occurred under peak loading conditions (not residual strength conditions) so that some of the values obtained would be much higher than residual strength values.

Based on the discussion above, it is our opinion that a reasonable shear strength characterization that averages conditions along the current landslide slip plane would indicate a residual friction value of 20 to 25 degrees and no cohesion. The studies by both TI and KI conclude that with the conservative groundwater levels discussed above, a residual friction angle of 22 degrees would be necessary to achieve a factor of safety of 1.50 under static loading conditions. It is our judgment that this residual strength is a reasonable estimate and we believe that the factor of safety for static loading of the ancient landslide is approximately 1.50.

3. Dynamic (Earthquake) Loading

The groundwater levels used in a dynamic (earthquake) analysis may not be quite as high as those assumed for the static analysis. This is because it is assumed that the groundwater levels change from time to time (generally lower during the summer and higher during the winter) and a static failure can occur whenever the groundwater is at its highest level. However, the likelihood that a large magnitude earthquake would occur at the same time as the highest groundwater levels is low and a somewhat lower groundwater level may be appropriate in the analysis for dynamic loading. KI (pages 18 and 19) has developed three groundwater levels which are intermediate between the highest groundwater level and a completely dry condition above the slide plane. It is our opinion that a reasonable groundwater level for dynamic loading may be one of these intermediate cases (Cases B, C, or D).

The most common way to assess slope stability under earthquake loading conditions for residential hillside projects is through the use of a seismic coefficient. It is our experience that seismic coefficients used in the highly seismic Bay Area usually range from between 0.15 and 0.25. The procedure outlined by KI which yields a coefficient of 0.32 is very conservative in our judgment. We believe that the value of 0.25 is more reasonably conservative for an Upper Level Earthquake, although some precedent has been established for the higher value quoted by KI during the extreme earthquake event. It is our opinion that the coefficient of 0.18 used for the Lower Level Earthquake event is appropriate.

Our experience and research on strengths used for old landslides under seismic loading generally indicates that these values should be significantly higher than the residual strengths used for static analysis. After reviewing the test data for the Oak Tree Farm site, it is our opinion that an appropriate and conservative shear strength for the dynamic analysis would be on the order of $\phi = 25$ degrees and C= 2000 pounds per square foot. Interpolating the values on Table 5 in the TI report using the high ground water level and a strength of ϕ of 25 degrees and a cohesion of 2000 pounds per square foot, it appears that a factor of safety of approximately 1.10 to 1.15 would be obtained with a seismic coefficient of 0.25 and a factor of safety of approximately 0.95 to 1.00 would be obtained with a seismic coefficient of 0.32. We would generally

expect that a factor of safety of approximately 1.10 would be achieved with a conservative seismic coefficient of 0.25 and perhaps a factor of safety of 1.00 would be achieved with an extremely conservative seismic coefficient of 0.32. It is our opinion that the factors of safety computed are at the acceptable factors of safety, or slightly below these factors of safety, for these dynamic loading conditions. Therefore, it is our opinion it was appropriate to perform the additional deformational analysis provided by KI to predict the relative magnitude of movement which might occur during these seismic events because some deformation was possible. This is particularly important because we believe there is a much higher likelihood for the deep landslide to move in the future during an earthquake than during static conditions.

Our review of the dynamic analysis performed by KI indicates that it appears to be a thorough and credible assessment. As discussed earlier, it is our opinion that the strength which may be most appropriate for these materials under dynamic loading conditions would be a ϕ of 25 degrees and a cohesion of 2000 pounds per square foot. Furthermore, Groundwater Case B, C, or D may be more appropriate for dynamic loading conditions than Groundwater Case A. Finally, it is our opinion that the Upper Level Earthquake event is the more reasonable for application to this project than the Lower Level Earthquake because the Upper Level Earthquake conforms to Section 1629.2 of the 1994 Uniform Building Code that specifies "the ground motion representation shall, as a minimum, be one having a 10% probability of being exceeded in 50 years." Utilizing this criteria and applying it to Plate 21 of the KI report, it is likely that the horizontal displacements would be somewhat above, or roughly coincident with the location of the middle curve for the Upper Level Event. This would indicate that total deformations of eight or nine inches might occur on Lot 9 and one to two inches might occur near the base of the slope on Lot 5. (Please note that all of the lots were mis-labeled on Plate 21 in the draft copy we received and the area labeled Lot 11 is actually Lot 9 while the area labeled Lot 7 is actually Lot 5.)

The deformations which have been calculated by KI appear reasonable to us. They are in reasonable conformance with the magnitude of the deformations that Alan Kropp and Associates, in conjunction with the University of California at Berkeley, computed and measured in engineered fill materials during the 1994 Northridge Earthquake. The displacements obtained in the Northridge study are somewhat lower than computed by KI for this study because it is anticipated that the earthquake on the Calaveras fault which might trigger movements on the subject site would be somewhat larger and materials in the landslide complex are somewhat weaker.

In considering the impact of the estimated displacements, it is important to note that these are total displacements and not differential displacements. Differential displacements are typically the movements which damage structures or other improvements. For example, if an entire block of land on which a house was located moved 10 inches, and all of the house moved as a unit, then relatively little damage to the house would occur. However, if one portion of the house moved 5 inches while another portion of the house did not move (which would be termed 5 inches of differential movement), this could cause serious damage to the structure. Although it is impossible to predict the actual locations of differential movement during a landslide event, analyzing the information presented by KI on Plate 21 indicates that the most severe movements would take place on Lot 9. A 50-foot long structure on this lot might have a differential

movement of approximately 1 inch or a 100-foot long structure might have a differential movement of 2 inches. A house by the toe of the slope on Lot 5 would have differential movements of approximately half of those on Lot 9. It is our opinion that with a properly engineered design, structures and improvements to perform well even if this level of movement occurs. We should also note that these movements are only somewhat greater than typical movements which might occur in a hillside environment where the surficial soils are expansive clays and downslope creep-type movements occur. We should note that we also agree with TI that street pavement and utility lines can reasonably be designed to accommodate 9 inches of movement over 800 feet.

In summary, we concur with the analysis by TI and KI that indicates during a major earthquake (termed the Upper Level Earthquake), deformation of the landslide materials may occur. These deformations are not primarily slippage at the slide plane but deformations within the landslide mass itself. It is our opinion that the magnitude of deformations computed are reasonable and can be tolerated by well-engineered structures and improvements.

RECENT LANDSLIDES

1. General

The primary focus of the report by TI was the further analysis of the deep-seated, ancient landslide complex. However, some assessments were performed of more recent landslides and discussions were provided regarding mitigation measures which TI presented in a conceptual nature. KI only evaluated the ancient landslide complex and did not provide any evaluation of the shallower, more recent landslides. We have some disagreements with TI regarding the distribution of the landslides which we believe could affect the proposed lots and we also believe that additional mitigation measures may be needed where landslides are determined to be active. Discussions of various aspects of these more recent, active landslides are presented in individual sections below.

2. Activity Level

TI has indicated that the shallower landslides on the project can be subdivided into categories of recent, older active, and active landslides. In general, mitigation measures are being proposed for older active and active landslides while no measures are proposed for recent landslides.

In general, we agree with the mapping limits shown on Figure 2 of the TI report. TI implies that the older active landslides are not as serious a threat as the active landslides, but nonetheless do recommend limited remedial work in these areas. We believe that the older active landslides have nearly the same potential for future movements as the active landslides and remedial work for both types of landslides should be similar. Further, we are concerned that many of the areas of landslides termed "recent" by TI in the areas impacting

FUTURE STUDIES

As discussed earlier, remedial work schemes to resolve shallow instability problems for the proposed hillside lots have only been presented in a conceptual nature. When final details regarding these remedial work schemes are developed, we recommend that they be carefully reviewed by the City. We also recommend that the project applicant be encouraged to perform detailed monitoring of the groundwater levels within the hillside area during this upcoming winter.

The geotechnical and geological engineering opinions and conclusions presented in this letter are made in accordance with generally accepted geotechnical and geological engineering principles and practices. This warranty is in lieu of all other warranties, either expressed or implied. Our services have been provided at the request of the City of Pleasanton. Our role was to provide technical assistance to the City as it considers its permit decisions in this application and we understand our firms will be purported the same protection as the City under State law.

It has been a pleasure serving you on this project. If you have any questions, please feel free to call either of us.

Very truly yours,

William Lettis (JW)

William and Associates
William Lettis, C.E.G.

Alan Kropp

Alan Kropp and Associates
Alan Kropp, G.E.

mitigation measures

REGISTERED PROFESSIONAL ENGINEER
ALAN LEE KROPP
No. 487
Exp. 12/97
GEOTECHNICAL
STATE OF CALIFORNIA

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Currin Construction Company (1)
Attn: Bill Currin
Terrasearch, Inc. (1)
Attn: Simon Makdessi
Kleinfelder, Inc. (1)
Attn: Mike Majchrzak

Alan Kropp, CE, GE
Steven Kakihara, CE, GE
Garreth Saiki, CE
Jerrold Hanson, CE

ALAN KROPP & ASSOCIATES, INC. GEOTECHNICAL CONSULTANTS

February 26, 1997
1696-2, L 21367

Mr. Roger Higdon
City of Pleasanton
123 Main Street
Pleasanton, CA 94566

RE: Geotechnical/Geological Peer Review
Proposal Hillside Lot Studies
Oak Tree Farm, Tract 6898
Pleasanton, California

Dear Mr. Higdon:

This firm, in conjunction with William Lettis and Associates, recently completed a geotechnical/geologic peer review for the proposed Oak Tree Farm project. Recently, we were requested by a member of your staff to present our opinion regarding the conformance of the development scheme with Program 6.2 of the City of Pleasanton General Plan. The Oak Tree Farm Subdivision is designated as Tract 6898 and is located along Foothill Road in Pleasanton, California.

Program 6.2 is intended to allow the City to issue a permit for projects when the severity of geologic hazards are within tolerable limits. The intent of Program 6.2 is that projects in landslide-prone areas are to have such hazards mitigated so that the severity of damage is no greater than the types of damage which might occur in areas with low landslide potential. A detailed discussion of the anticipated magnitudes of movements of both deep-seated and shallow landslides was presented in our review letter to you dated December 9, 1996. We generally agree with the conclusion of the recent geotechnical studies that it is unlikely the deep-seated landslide deposit will reactivate during static (non-earthquake) conditions. If a significant earthquake occurred in most portions of the Bay Area, it is our opinion that little or no movement of this deep-seated landslide would occur. If a major earthquake occurred on the nearby section of the Calaveras fault, then some movements of the deep-seated landslide may occur (see Pages 6 and 7 of our December 9, 1996 letter). However, the differential movement associated with such landslide movements is similar to those which may occur due to expansive clays on flat sites or moderately steep sites where no landslides are occurring. Therefore, it is our opinion that the earthquake-induced landslide movements are similar to the magnitudes of movements which might occur on the non-landslide terrain.

There are a number of shallow landslides within the proposed project. If these landslides are properly

510-841-8357

mitigated, it is our opinion that there should not be significant movement associated with these shallow landslides. Details of these shallow landslide repairs have not been developed to date, and we recommend that we review such details as they are developed to confirm that they will appropriately mitigate the possible landslide movement.

The geotechnical and geological engineering opinions and conclusions presented in this letter are made in accordance with generally accepted geotechnical and geological engineering principles and practices. This warranty is in lieu of all other warranties, either expressed or implied. Our services have been provided at the request of the City of Pleasanton. Our role was to provide technical assistance to the City as it considers its permit decisions in this application and we understand our firms will be purported the same protection as the City under State law.

It has been a pleasure serving you on this project. If you have any questions, please feel free to call.

Very truly yours,

Alan Kropp

Alan Kropp and Associates
Alan Kropp, G.E.

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